Library

JUN 12 1929

With METALLURGICAL SUPPLEMENT.

The Engineer.

Established 1856. Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXLVII.—No. 3829] LONDON: FRIDAY EVENING, MAY 31, 1929 [PRICE { WITH SUPPLEMENT } ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

HEATING, &c.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Thursday, 20th June, 1929, for LOW-PRESSURE HOT WATER HEATING, HOT WATER and FIRE SERVICES, at the State Institution, Rampton, Retford.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 2078

The Director-General, India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for—

SCHEDULE 1.—10 COPPER TUBE PLATES, flanged.
SCHEDULE 2.—108 PAIRS DISC WHEELS and AXLES, broad gauge.
SCHEDULE 3.—5000 HELICAL DRAWBAR SPRINGS.
SCHEDULE 4.—About 650 Tons of CAISSONS and WELL CURBS for Irrawady Bridge.

Tenders due as follows :—
Schedules 1 to 3, 11th June, 1929.
Schedule 4, 18th June, 1929.

Forms of Tender available from the above at a fee (which will not be returned) of 5s. for each schedule. 2084

TRACER.

Applications are INVITED for the POSITION of LADY TRACER at the Admiralty Engineering Laboratory, West Drayton, Middlesex. Candidates should be at least 21 years of age and fully qualified.

The maximum commencing salary is 44s. per week, according to experience, and will be subject to variation with the cost-of-living index figure.

Apply, enclosing sample of work and stating age and experience, to the SUPERINTENDENT. 2011

Crown Agents for the COLONIES.
COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POST :—

M/732.—CIVIL ENGINEER REQUIRED by the GOVERNMENT of CEYLON for appointment as Irrigation Engineer for three years' service and prospect of permanency. Salary £500, rising to £900 a year by annual increments of £40 (£600 a year on attaining 30 years of age). Free quarters and free passages provided. Candidates, unmarried, 26 to 31 years of age, must have passed examination to qualify for Associate Membership of the Institution of Civil Engineers or hold professional qualifications recognised by the Institution as exempting from Parts A and B of that examination, and have had at least three years' practical experience on Waterworks, Drainage or Harbour and Dock Works.

Apply at once by letter, stating age and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/732. 2081

Department of Scientific and Industrial Research.

JUNIOR ASSISTANT (Engineer) REQUIRED at the Fuel Research Station, East Greenwich. Candidates must have a good Honours Degree in Engineering or equivalent qualification, and some research or practical experience. Scale of salary £175-15-£235 per annum plus Civil Service bonus ; initial pay approximately £265. Superannuation provision will be made under the Federated Superannuation System for Universities.

Further particulars and application forms can be obtained from the SECRETARY, Department of Scientific and Industrial Research, 16, Old Queen-street, Westminster, S.W. 1, to whom the latter should be returned not later than June 6th. 1949

Ministry of Transport.
RAMSGATE HARBOUR.

APPLICATIONS are INVITED for a non-pensionable APPOINTMENT as HARBOUR MASTER and ENGINEER with an inclusive scale of pay £550-25-600 per annum. An official residence is provided.

Candidates should be Chartered Civil Engineers with experience of Harbour Management and Harbour Engineering Work.

Preference will be given to candidates who have served in His Majesty's Forces.—Forms of application can be obtained from the ESTABLISHMENT OFFICER, Ministry of Transport, Whitehall-gardens, S.W.1, to whom they should be returned not later than the 15th June.

May, 1929. 2012

Administrative County of LONDON.
ROBERT BLAIR FELLOWSHIPS IN APPLIED SCIENCE AND TECHNOLOGY.

APPLICATIONS are INVITED for the AWARD of TWO ROBERT BLAIR FELLOWSHIPS in APPLIED SCIENCE and TECHNOLOGY, each of the value of £450, tenable for one year. The Fellowships are for advanced study or research in applied science and technology, and will be tenable in the Dominions, the United States or other foreign countries.

Candidates must be British subjects and at least twenty-one years of age.

Further particulars and application forms (T. 2) may be obtained from the Education Officer (T. 2), the County Hall, S.E. 1 (stamped addressed envelope necessary), to whom the form must be returned by 18th June, 1929.

MONTAGU H. COX,
1574 Clerk of the London County Council.

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.
ARRANGED FOR CARD INDEXING.

The Metallurgist.
THE ENGINEER, 31 - 5 - 29.

The Shannon Hydro-Electric Power Scheme No. VI. (P. 590)
THE ENGINEER, 31 - 5 - 29.

The North-East Coast Exhibition No. III. (P. 596)
THE ENGINEER, 31 - 5 - 29.

A Visit to an Electric Motor-Control Gear Factory. (P. 607)
THE ENGINEER, 31 - 5 - 29.

The Replica of the "Rocket." (P. 592)
THE ENGINEER, 31 - 5 - 29.

The Study of Markets. (P. 601)
THE ENGINEER, 31 - 5 - 29.

The Holland-America Liner "Statendam." (P. 602)
THE ENGINEER, 31 5 - 29.

Spain. (P. 601)
THE ENGINEER, 31 - 5 - 29.

A 300 kW Self-contained Geared Turbo-Generator. (P. 605)
THE ENGINEER, 31 - 5 - 29.

INDEX TO ADVERTISEMENTS, PAGE 77.

PUBLIC NOTICES

Armstrong College,
NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.Sc. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
1721 Newcastle-upon-Tyne.

The Madras and Southern MAHRATTA RAILWAY COMPANY, Limited, invite TENDERS for :—

83.75 TONS STRUCTURAL STEEL WORK for SMITHY and DROP STAMP SHOP (together with Bolts and Nuts, Patent Glazing, Galvd. C.I. Piping, &c. &c.).

Tenders are due in on Monday, 1st July, 1929, by 10.30 a.m.

Tender form obtainable at Company's offices ; fee One Guinea, which is not returnable.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices :
25, Buckingham Palace-road,
Westminster, S.W. 1. 2079

PUBLIC NOTICES

Administrative County of LONDON.

The London County Council invites APPLICATIONS for the POSITION of DISTRICT INSPECTOR OF SCHOOLS (Technical Education) in the Education Officer's Department.

Salary £500 a year, rising by annual increments of £25 to £600 and thence by annual increments of £50 to a maximum of £800, together with temporary additions varying according to the cost of living. At the present time the total commencing salary is £671.

In exceptional circumstances the Council may be prepared to appoint the selected candidate at a point on the scale above the minimum.

DUTIES.—To conduct and assist in conducting the inspection of schools, colleges and institutes and to inspect and advise upon instruction in technical subjects. Candidates should possess engineering or similar technical qualifications as well as teaching experience.

Apply (clearly specifying position) to the Education Officer (C. 1), The County Hall, Westminster Bridge, S.E. 1 (stamped addressed foolscap envelope essential), for form of application, which must be returned not later than Monday, 10th June.

Canvassing disqualifies.

MONTAGU H. COX,
1935 Clerk of the London County Council.

Bracebridge Mental Hospital, LINCOLN.
HEATING INSTALLATION, &c. (VACUUM RETURN SYSTEM).

The Visiting Committee of the Bracebridge Mental Hospital are desirous of obtaining TENDERS for a CENTRAL HEATING SYSTEM and HOT WATER SERVICE for Two New Villas now being erected at Bracebridge Heath, near Lincoln.

A list of suitable firms wishing to Tender for this work will be prepared, from which not less than six will be selected and to whom the plans and specifications will be submitted by the Consulting Engineer to the Committee, Mr. E. G. Phillips, M.I.M.E., A.M.I. Mech. E., for the purpose of receiving Tenders, which will be duly considered by the Committee concerned.

Application for inclusion in the list from which selection will be made should be addressed in the first place to

HAROLD E. PAGE,
Clerk to the Visiting Committee.
2018 5 and 6, Bank-street, Lincoln.

PUBLIC NOTICES

City of Nottingham.
BOARD OF GUARDIANS.
HEATING, COOKING, STERILISING, HOT WATER AND STEAM SUPPLY PLANT.
BAGTHORPE INFIRMARY AND INSTITUTION, HUCKNALL-ROAD, NOTTINGHAM.

The Guardians of the Poor of the City of Nottingham invite TENDERS for the ERECTION of HEATING, COOKING, STERILISING, HOT WATER and STEAM SUPPLY PLANT at the Bagthorpe Infirmary and Institution, Hucknall-road, Nottingham.

Tenders must include for the whole of the work specified, and not sections only.

Plans, specification and schedule of quantities may be seen on application to me or to the Consulting Engineer, Mr. T. J. R. Kiernan, B.Sc., M. Inst. C.E., Artillery House, Artillery-row, Victoria-street, Westminster, London, S.W. 1, between the hours of 10 a.m. and 4 p.m.

Copies of the plans, specification and schedule of quantities can be obtained ONLY FROM ME, upon deposit of a Five Pound Bank of England Note, which will be returned on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Heating Plant, Bagthorpe Infirmary and Institution," must be sent to reach me, the undersigned, not later than 4 p.m. on Monday, the 24th June, 1929.

The Guardians do not bind themselves to accept the lowest or any Tender.

By Order,
J. ALLAN BATTERSBY,
Clerk to the Guardians.

Poor Law Offices,
50, Shakespeare-street, Nottingham,
31st May, 1929. 2056

Farnham Urban District COUNCIL.
CONTRACT NO. 5.
WRECCLESHAM DRAINAGE.
TO CONTRACTORS.

The Farnham Urban District Council are prepared to receive TENDERS for the CONSTRUCTION of STONEWARE and CAST IRON SEWERS of 7in. and 9in. diameter, together with MANHOLES, FLUSHING TANK, VENTILATING SHAFTS and other appurtenant WORKS in accordance with the plans and specification prepared by the Engineers, Messrs. John Taylor and Sons, Caxton House, Westminster, S.W. 1.

Copies of the specification, bill of quantities and form of Tender may be obtained and the drawings may be seen at the offices of the Engineers upon payment of £5 (cheque only), which will be returned upon receipt of a bona fide Tender.

Sealed Tenders, endorsed "Wrecclesham Drainage, Contract No. 5," addressed to the undersigned at his office at Farnham, must be received before Noon on Saturday, the 15th day of June, 1929.

The Council does not bind itself to accept the lowest or any Tender.

(Sgd.) A. A. MINNS,
Acting Clerk.

Council Offices,
Farnham, Surrey. 2073

Rural District of Truro, CORNWALL.
PARISH OF PERRANZABULOE.
PERRANPORTH DRAINAGE SCHEME.
CONTRACT NO. 2.
FOR EJECTORS OR HIGH-LIFT CENTRIFUGAL PUMPING PLANT.
(RELIEF OF UNEMPLOYMENT SCHEME.)

The Rural District of Truro invite TENDERS from competent firms of contractors specialising in Ejectors or Pumping Plant for the SUPPLY, DELIVERY and FIXING of 3 SEPARATE INSTALLATIONS of EJECTORS or alternatively HIGH-LIFT CENTRIFUGAL PUMPING PLANT, electrically driven and automatically controlled, for dealing with the sewage from the district of Perranporth, within the above-named Parish and Rural District.

Copies of the general conditions, specifications, &c., may be obtained and the plans and sections inspected on and after June 7th, 1929, on application to the Council's Consulting Engineer, James D. Haworth, M.S.E., M.R. San. I., F.G.S., at his office, No. 3, Central-building, Westminster, S.W. 1, upon payment of a deposit of Five Pounds, which sum will be returned after consideration of all bona fide Tenders received.

The Council do not bind themselves to accept the lowest or any Tender.

Tenders (accompanied by plans and sections of the proposed plants) must be sealed and delivered to the undersigned not later than Noon on Tuesday, June 18th, 1929.

EDWARD J. REPPER,
Deputy Clerk.

Council Offices,
12, Princes-street,
Truro, Cornwall.
Dated May 31st, 1929. 2050

PUBLIC NOTICES (continued) Page 2.
SITUATIONS OPEN, Page 2.
SITUATIONS WANTED, Page 2.
AUCTIONS, Page 78.
MACHINERY, &c., WANTED, Page 78.
BUSINESSES and PREMISES (For Sale, etc.). Page 78.
EDUCATIONAL, Page 4.
PATENTS, Page 4.
PARTNERSHIPS, Page 2.
MISCELLANEOUS, Page 4.
AGENCIES, Page 4.
FOR SALE, Page 4.
WORK WANTED, Page 78.
FOR HIRE, Page 78.

For Advertisement Rates see Leader Page.

PUBLIC NOTICES

Manchester Corporation.

The Rivers Committee invite TENDERS for the CONSTRUCTION of EFFLUENT CULVERT and SURPLUS SLUDGE MAIN (DAVYHULME SEWAGE WORKS EXTENSION, WORK NO. 5A).

Plans may be seen and specification, bill of quantities, and form of Tender obtained on or after Monday, 27th May, 1929, on application at the City Engineer's Office, Town Hall, Manchester, on payment to the City Treasurer of £5 5s., which sum will, after the Corporation have come to a decision upon the Tenders received, but not before, be returned to the person submitting a bona fide Tender. All cheques or postal orders are to be made payable to the order of "The Corporation of Manchester."

Tenders, enclosed in the official envelope and addressed to the "Chairman of the Rivers Committee," are to be delivered at the City Engineer's Office not later than 9.30 a.m. on Thursday, the 13th day of June, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

F. E. WARBRECK HOWELL,
Town Clerk.

Town Hall, Manchester,
22nd May, 1929. 2007

Metropolitan Borough of

SAINT PANCRAS.
ELECTRICITY DEPARTMENT.
MOTOR CONVERTER.

TENDERS are INVITED for ONE 1000-kW MOTOR CONVERTER.

Specification and form of Tender may be obtained on application at the offices of the Electricity Department, 57, Pratt-street, N.W. 1, on payment of £1, which will be returned on receipt of a bona fide Tender.

Sealed Tenders to be sent in not later than Twelve Noon on Thursday, the 6th June, 1929, to the undersigned, and endorsed "Tender for Motor Converter."

The Council do not bind themselves to accept the lowest or any Tender.

F. V. CREED,
Town Clerk.

Town Hall,
Pancras-road, N.W. 1. 1892

Parish of St. Mary, Islington.

HYDRAULIC PUMP, &c.

The Guardians of the Poor of the Parish of St. Mary, Islington, invite TENDERS for the SUPPLY and ERECTION of a HYDRAULIC PUMP, &c., at their Infirmary, Highgate Hill, N. 19.

Official forms of Tender (which alone will be received) can be obtained from the Clerk to the Guardians personally at the undermentioned address, or a stamped addressed foolscap envelope may be sent.

The site can be inspected by appointment with the Steward of the Infirmary (Telephone No., Mountview 1882), from whom further particulars can be obtained.

Sealed Tenders must be delivered at the undermentioned offices not later than 3 p.m. on Thursday, the 27th day of June, 1929, and they will be opened at a meeting of the Guardians on that day.

The Guardians do not bind themselves to accept the lowest or any Tender.

By Order,
ALBERT KING,
Clerk to the Guardians.

Guardians' Offices,
St. John's-road,
Upper Holloway, N. 19.
21st May, 1929. 2064

Parish of St. Mary, Islington.

COLD STORAGE AND ICE-MAKING PLANT.

The Guardians of the Poor of the Parish of St. Mary, Islington, invite TENDERS for the SUPPLY and ERECTION of COLD STORAGE and ICE-MAKING PLANT at their Infirmary, Highgate Hill, London, N. 19.

Official forms of Tender (which alone will be received) can be obtained from the Clerk to the Guardians personally at the undermentioned address, or a stamped addressed foolscap envelope may be sent.

The site can be inspected by appointment with the Steward of the Infirmary (Telephone No., Mountview 1882), from whom further particulars can be obtained.

Sealed Tenders must be delivered at the undermentioned offices not later than 3 p.m. on Thursday, the 27th day of June, 1929, and they will be opened at a meeting of the Guardians on that day.

The Guardians do not bind themselves to accept the lowest or any Tender.

By Order,
ALBERT KING,
Clerk to the Guardians.

Guardians' Offices,
St. John's-road,
Upper Holloway, N. 19.
21st May, 1929. 2065

South Indian Railway Company,

PANY, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. SIGNALLING and INTERLOCKING MATERIALS (ii).
2. MILD STEEL BARS, SECTIONS, &c., for MISCELLANEOUS PURPOSES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Signalling and Interlocking Materials (ii)," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 21st June, 1929, in respect of Specification No. 1, and 14th June, 1929, in respect of Specification No. 2.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of £1 for each copy of Specification No. 1, and of 10s. for each copy of Specification No. 2.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1.
29th May, 1929. 2080

Waterford Harbour.

WANTED, 10-TON TRAVELLING HAND CRANE.

The Commissioners for Improving the Port and Harbour of Waterford invite contractors to submit TENDERS on or before the 8th June, 1929, for the SUPPLY and DELIVERY on the Quay, Waterford, of a SECOND-HAND 10-TON, not less than 24ft. radius, Hand Power Operated HOISTING, SLEWING, and TRAVELLING CRANE, with change gear to hoist lesser loads than 10 tons at quicker hoisting and slewing speeds.

Firms tendering to furnish with their Tender full working drawings and detailed specification of the cranes they offer and state where crane can be inspected.

The lowest or any Tender will not necessarily be accepted.

For further particulars apply to
AUSTIN A. FARRELL,
Secretary and General Manager.

Harbour Office, Waterford,
15th May, 1929. 1937

Mechanical Engineer Required

by the Hornsey Corporation as WORKS SUPERINTENDENT at their Chief Depot. Must have good knowledge of Steam and Electrical Plant and Motor Transport. Good disciplinarian. Salary £350 per annum, subject to 5 per cent. deduction for Superannuation Scheme.

Reply, with full particulars of experience, age, and copies of testimonials, not later than June 14th, to the BOROUGH ENGINEER, Town Hall, Highgate, N. 6. 2041

PUBLIC NOTICES

Perak River Hydro-Electric

POWER COMPANY, LIMITED.

APPLICATIONS are INVITED (by letter only) from properly qualified candidates for immediate APPOINTMENT in Malaya as

INSPECTORS FOR REINFORCED CONCRETE WORK.

Two required, one of whom must have had special experience in grouting work by machine.

Applicants must be experienced Clerks of Works, thoroughly conversant with general work connected with civil engineering, especially reinforced concrete and levelling; age 30-40 years. Salary £450 to £550.

Selected candidates for these posts will only be appointed subject to passing a strict medical examination.

Agreement for about 1 year, subject to extension, free second-class passage to Malaya and home again on satisfactory termination of service.

Applicants must forward details of career, giving particulars of education (general and technical), practical training, and subsequent experience, with names of employers, appointments held, and dates of such employment, together with COPIES ONLY of testimonials, &c., to the undersigned as soon as possible, but in any case not later than 8th June, 1929. Applications will be considered as received.

RENDEL, PALMER AND TRITTON,
Appointments Dept.,
2025 13, Dartmouth-street, Westminster, S.W. 1.

Sudan Government Require

the SERVICES of a CIVIL ENGINEERING DRAUGHTSMAN for Irrigation Work. Age 30-35. Candidates should have the necessary technical qualifications to prepare design of structures and canals, calculations for design, taking out quantities, if necessary prepare own drawings and tracings, supervision of junior staff, drawing-office records and organisation. Salary £E480-600 per annum, according to age, qualifications and experience (£E1 equals £1 0s. 6d.). Temporary contract for two years. Strict medical examination. Free first-class passage.

Apply by letter, giving age, details of education training and experience, to ADVISORY ENGINEER, Sudan Government London Office, Wellington House, Buckingham-gate, S.W. 1, marking letters "Draughtsman." 2039

Sudan Government Require

the SERVICES of TWO ASSISTANT ENGINEERS for Irrigation Construction Work. Candidates should have passed the Associate Examination of the Institution of Civil Engineers or should hold an equivalent Degree and have had previous experience in constructional work and surveying and levelling. Salary £E480-600 per annum, according to age, qualifications and experience (£E1 equals £1 0s. 6d.). Temporary contract for two years. Strict medical examination. Free first-class passage.

Apply by letter, giving age, details of education, training and experience, to ADVISORY ENGINEER, Sudan Government London Office, Wellington House, Buckingham-gate, London, S.W. 1, marking letters "Irrigation Engineer." 2038

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED by British Firm for India, Fully Qualified ENGINEER, with good experience of Steam Pipe Installation Work and Irrigation and Waterworks. To be capable of designing water schemes complete and reporting on same, particularly in connection with pipe work. Age 25 to 30, bachelor preferred. State qualifications and experience and where educated.—Address, 2020, The Engineer Office. 2020 A

WANTED for Calcutta, Thoroughly Capable ASSISTANT for Engineering and Repair Workshops. State age and give full particulars of training and experience; medical examination necessary; five years' engagement. Preference given to North countryman or Scot.—Apply, with fullest details, to JOHN SHAW and SONS (WOLVERHAMPTON), Limited, Wolverhampton. 2071 A

WANTED for Service in India, ENGINEER to Supervise Erection and Setting to Work High-tension Traction Sub-stations. Applicants should be between ages 30 and 40 and preferably should have had previous experience of similar work. Appointment may be for 3 or 4 months only or for a more extended period. Applications, stating age, salary required, particulars of experience, and references, should be sent not later than 12th June.—Address, 2068, The Engineer Office. 2068 A

WANTED for Service in a Factory Near Paris, France, experienced TOOL and GAUGE DESIGNER. Must be good on Fixtures, Air Chuck Work, and have a knowledge of Designing Brass Forging Dies. Only experienced men need apply.—Answer by letter to CIE. CRANE, Rue de Verdun, La Courneuve, Seine, France. 2055 A

WANTED, MASTER ROLL TURNER for India. Absolutely first-class man, with extensive experience Roll Design, competent supervise Rolling all Sections and associate himself with each mill department, view obtaining best possible results. Age not over 45; 3 years' standard contract, passage out and home, two-thirds salary while travelling.—Reply fullest particulars, copies of testimonials, to Z.D. 368, care Deacon's Advertising Offices, Fenchurch-avenue, London, E.C. 3. 2082 A

WANTED, MECHANICAL ENGINEER, with Some Civil Engineering experience, to fill post in South Europe; knowledge of Spanish desirable.—Write, stating age, experience, salary required, to "M.E.," c/o Street's, 6, Gracechurch-street, E.C. 3. 2016 A

WANTED, SHOP SUPERINTENDENT, Age 30-35, for new factory at Acton, making small accurate repetition work. Must have experience Automatics, Limit Gauging. Good prospects energetic man. State in confidence age, education, experience, salary required, and when available.—Address, 2042, The Engineer Office. 2042 A

WANTED to Sail in September for a First-class Structural and Bridge-building Works in India, a qualified ASSISTANT WORKS MANAGER, age about 30; salary to commence at equivalent of approximately £750 a year, with excellent prospects of advancement; must have had previous experience in similar capacity. Agreement for 5 years.—Apply with copy of photograph and full particulars to ZZ 301, care Deacon's Advertising Agency, Fenchurch-avenue, London, E.C. 3. 1992 A

ASSISTANT WORKS MANAGER WANTED for Hong Kong, age 27-30, with good technical and practical training in Marine Engine Construction. Liberal salary will be paid to a man with the necessary qualifications. State age and full details of experience.—Address, "EAST," Wm. Porteous and Co., Advertising Agents, Glasgow. P5845 A

ELECTRICAL ENGINEER, with Degree or Equivalent, at least three years' works experience, and familiar with Light Current and Valve Amplifier Work, REQUIRED for Experimental Work.—Applications should be tabulated and give full particulars of work done and certificates obtained, with dates, age, and salary required, to Box E247, c.o. C. Mitchell and Co., 1, Snow-hill, E.C. 1. 1987 A

A LARGE Engineering Firm in London REQUIRES the SERVICES of a CHIEF RATEFIXER. Applicants must be fully experienced in all branches of Ratefixing for the highest class Automobile Production; capable of Taking Charge of the Ratefixing Department and have held a similar position previously.—Address, giving full details of experience, qualifications, age and salary required, 1958, The Engineer Office. 1958 A

SITUATIONS OPEN (continued)

ENERGETIC WORKS MANAGER REQUIRED for works near London employing about 200 men; age 30-40, thorough knowledge latest practice in Machine Shop, Plate Shop and Foundry; must be good mechanical engineer with technical qualifications. Salary £700 p.a. Copies of refs., details of qualifications.—Address, 2035, The Engineer Office. 2035 A

ENGINEER SALESMAN, to Control London Office and Warehouse handling special alloys; must have sound engineering experience with chemical knowledge; good education and address essential. Progressive position for first-class man.—Address, 2022, The Engineer Office. 2022 A

GENERAL and WORKS MANAGER for Old-established Engineering Works and Foundry. State age, education, fullest particulars of experience, and class of work, also salary required, which will be treated in strictest confidence. This is a first-class opportunity for the right man.—Address, P5863, The Engineer Office. P5863 A

METALLURGICAL CHEMIST WANTED for a large Non-ferrous Foundry in London. Previous works experience in metal mixing, melting and control essential. State age, qualifications, salary, &c.—Address, 2017, The Engineer Office. 2017 A

OLD-ESTABLISHED ENGINEERING COMPANY in India REQUIRE a YOUNG MAN of good address and personality, not over 23; must be single, with technical training and salesmanship experience in Engineers' Hardware or Iron and Steel.—Write fully, stating age, education, training and experience, also present employment and salary, Z.A. 324, c/o Deacon's Advertising Agency, Fenchurch-avenue, London. 2067 A

REQUIRED by Lancashire Firm of Engineers (200/300 men), COMMERCIAL MANAGER. Applicants must have had considerable works experience. Replies should contain full information as to experience, age, and salary expected. Position vacant is a permanent and progressive one to man of ability and energy.—Address, 2060, The Engineer Office. 2060 A

SALES MANAGER REQUIRED for an Engineering Works building specialities.

Position requires a man of good education and presence, age 30 to 35, with thorough knowledge of sales investigation and office procedure.

Applicants to give full details of education, training and experience, send copies of any testimonials, also to state age and whether married or single.

Address, 2033, The Engineer Office. 2033 A

THE BRITISH ENGINE, BOILER and ELECTRICAL INSURANCE CO., Ltd., 24, Fennel Street, Manchester, REQUIRE an ENGINEER-SURVEYOR who must be a practical Engineer with experience in the construction, erection and repairs of Cranes and Lifts, and should have a good theoretical knowledge and be able to make dimension sketches. Duties to include the examination and testing of all classes of cranes, lifts, and other lifting appliances. Salary to commence £260 per annum.—Apply by letter only, marked "Crane and Lift Surveyor," giving age, which should be between 28 and 30 years, outline of experience, particulars of certificates of theoretical knowledge, and copies of testimonials. HARRY M. LONGRIDGE, Manager. 2048 A

WORKS MANAGER for Large Bridge and Structural Works in India. Candidates must be well educated and have had experience in modern shop practices. Salary 1300 rupees per month with commission on profits.—State age, training, and experience, GENERAL MANAGER, Braithwaite and Co., Engineers, Ltd., West Bromwich. 2021 A

YOUNG ENGINEER, Age 30 to 35, to Assist Works Manager of small but well-established works in Birmingham area making special and high-class Sheet Metal and Light Constructional Work. Must have had a good education, and some practical experience, able to deal with correspondence and fix piecework rates. Previous experience in similar positions an advantage, but not essential. Very good prospects for an energetic worker. Give age, full particulars of experience, and salary required.—Address, 2014, The Engineer Office. 2014 A

WANTED, DRAUGHTSMEN (One Senior and One Improver), with good all-round experience of Automobile and similar work for Ball Bearing Manufacturers. State full experience, salary required and when available.—Address, 2002, The Engineer Office. 2002 A

CHIEF DRAUGHTSMAN WANTED for the Midlands of Scotland. Must be thoroughly conversant with the latest designs of Jigs, Tools and Fixtures for motor car industry. State experience, age, salary, and when free.—Address, "DRAUGHTSMAN," Wm. Porteous and Co., Advertising Agents, Glasgow. P5858 A

DETAIL DRAUGHTSMEN REQUIRED, Used to Internal Combustion Engine Work.—Write, giving particulars of past employment, age, and salary required, Box 105, Advertising Offices, 84, Queen Victoria-street, London, E.C. 4. 2015 A

DRAUGHTSMEN, Capable Young, REQUIRED for Aircraft Detail Design Work. Must be quick and accurate.—Write, giving age, experience, and salary required, to HANDLEY PAGE, Ltd., Cricklewood, N.W. 2. 1859 A

DRAUGHTSMAN, JIG and TOOL. Senior Man for high production of Car Components. Good prospects for suitable applicant. Only first-class man considered.—Write, Box 542, Dorland, 14, Regent-street, S.W. 1. P5847 A

DRAUGHTSMAN, Mechanical, with A.C. or D.C. Motor Details experience preferred.—Address, stating age, experience, and salary required, 1943, The Engineer Office. 1943 A

DRAUGHTSMAN REQUIRED for New Country Works; must be energetic and experienced General Engineering. State qualifications, age, and salary required.—Address, 2085, The Engineer Office. 2085 A

DRAUGHTSMAN WANTED in Birmingham. Age about 24 years, with Mechanical Engineering experience.

Address, stating age, experience and salary required, P5866, The Engineer Office. P5866 A

DRAUGHTSMEN WANTED for London Works. Must have had experience with Printing Presses. Write full particulars and salary required.—Address, 2029, The Engineer Office. 2029 A

DRAUGHTSMAN WANTED for Machine Arrangements and Shop Details. State age, experience, and salary required.—Address, 2076, The Engineer Office. 2076 A

DRAUGHTSMAN, with Experience of Motor Accessory and Instrument Work. Good prospects and permanency. State exp., salary req'd.—SMITHS, Cricklewood Works, N.W. 2. 2069 A

DRAUGHTSMAN, with Experience of Motor Accessory and Instrument Work; good prospects and permanency. State experience, salary required.—Box 4586, Woodwright Service, 150, New Bond-street, W. 1. 2003 A

EXPERIENCED STEEL WORK DRAUGHTSMAN for Power Station Design.—Apply (letters only), stating age, full experience, references, and salary required, to C. S. ALLOTT and SON, Consulting Engineers, North Parade, Manchester. 2075 A

FIRST-CLASS MECHANICAL DRAUGHTSMAN REQUIRED for Iron and Steel Works on N.E. Coast. Age 28-35. Must have a thorough knowledge of Plant Design. Applicable to work of this description.—Address, stating age and salary required, 2019, The Engineer Office. 2019 A

SITUATIONS OPEN (continued)

JUNIOR DRAUGHTSMAN REQUIRED for Office in Westminster. Must be a very neat and quick tracer, also neat in lettering on finished tracings.—Apply, stating experience, wages required, whether disengaged, and specimen of lettering, to Box No. 2478, c/o Brown's, 39, Tothill-street, Westminster. 2037 A

JUNIOR DRAUGHTSMAN REQUIRED in Drawing-office of Structural Steel Works, London district.—Address, stating age, salary expected, and giving outline of previous experience, 2049, The Engineer Office. 2049 A

JUNIOR JIG and TOOL DRAUGHTSMAN REQUIRED, large Engineering Works, 30 miles London. Workshop training essential. State age, experience, and salary required.—Address, 2031, The Engineer Office. 2031 A

JUNIOR DRAUGHTSMAN WANTED, West of England district. Preference will be given to a man who has had good workshop experience in General Engineering Works. State age, references, salary.—Address, 2063, The Engineer Office. 2063 A

LADY TRACERS, Experienced, WANTED for London office.—Address, stating age, experience, and salary required, 2077, The Engineer Office. 2077 A

LIFTS.—Qualified DRAUGHTSMAN WANTED, with first-class Electrical Design and Layout experience and fully conversant with modern practice. Full particulars, experience, salary required.—Address, 2040, The Engineer Office. 2040 A

LONDON CONSTRUCTIONAL ENGINEERS REQUIRE DRAUGHTSMEN with previous similar experience. Send full particulars of age, salary, &c.—Address, 2083, The Engineer Office. 2083 A

LONDON FIRM of Constructional Engineers REQ. a smart JUNIOR DRAUGHTSMAN; experience of Steel-frame Buildings essential. State age, experience, and salary.—Address, 2047, The Engineer Office. 2047 A

MACHINE TOOL DESIGNER.

WANTED, First-class MACHINE TOOL DESIGNER for French Machine Tool Firm, already employing six English Draughtsmen.

Only men with actual Machine Tool Design Experience gained with first-rate Machine Tool Makers need apply; all others, including jig and tool draughtsmen, please abstain.

Apply, stating age, salary required, and when at liberty to—

ETABLISSEMENTS CHARLES BERTHIEZ,
44, Rue Lafayette,
P5867 A Paris.

MACHINE TOOL DRAUGHTSMEN REQUIRED.—Apply, giving full particulars, age, and salary expected, to ALFRED HERBERT, Ltd., Coventry. 2034 A

NORTH-EAST FIRM REQUIRES DRAUGHTSMAN, fully experienced Blast-furnace Operation and Design.—Write, giving full particulars, age, and salary required, to Z.D. 348, care Deacon's Advertising Offices, Fenchurch-avenue, E.C. 3. 2066 A

RANSOMES and RAPIER, Ltd., Ipswich, REQUIRE a First-class DESIGNING DRAUGHTSMAN with experience in all types of Excavating Machinery. Applications should give full particulars of experience, age, and salary required. 2058 A

SENIOR and DETAIL DRAUGHTSMEN REQUIRED for Metal Aircraft Construction.—State age, experience, and salary required to SHORT BROS., Ltd., Rochester. 2032 A

SENIOR DRAUGHTSMAN REQUIRED in Westminster, with knowledge of Furnace Design and Combustion. Must also have had workshop experience. State age, previous career and salary required.—Address, 2030, The Engineer Office. 2030 A

SENIOR JIG and TOOL DRAUGHTSMAN WANTED. Only those with first-class production experience need apply. State age and salary required.—Address, 2026, The Engineer Office. 2026 A

WATER-TUBE BOILER MANUFACTURERS REQUIRE the SERVICES of an ASSISTANT CHIEF DRAUGHTSMAN. Only those with sound knowledge of this class work need apply.

Address in first instance, stating age, salary expected, and previous experience, 2074, The Engineer Office. 2074 A

SITUATIONS WANTED

A.M.I. MECH. E., with Wide Technical, Executive and administrative experience, shortly returning from the Near East, is OPEN to CONSIDER any RESPONSIBLE POST, technical or commercial, at home or abroad. Special experience in steel works and oil works practice.—Letters to Box C.R., c/o Davies and Co., 95, Bishopsgate, E.C. 2. 1963 B

ENGINEER, Experienced in Crushing, Grinding, screening and pulverised fuel elevating and conveying machinery, OPEN TO ENGAGEMENT; can influence orders.—Address, P5844, The Engineer Office. P5844 B

ENGINEER (33), Mechanical, Constructional, Speaks French, Spanish, 10 years' experience at home and abroad, DESIRES POSITION at home or overseas; accustomed to handle labour; public school.—Address, P5851, The Engineer Office. P5851 B

ENGINEER (30) SEEKS RESPONSIBLE POSITION; public school education, experienced shops, D.O., assistant engineer, works extensions and maintenance.—BM/Lo24, London, W.C. 1. P5860 B

MACHINE SHOP SUPERINTENDENT.—ADVERTISER, who is at present disengaged, SEEKS a PROGRESSIVE POSITION in like capacity; well able to control labour, and good organiser. Similar positions have been held with leading engineering and motor car firms.—Address, P5854, The Engineer Office. P5854 B

MAINTENANCE ENGINEER.—Good PRACTICAL ENGINEER, expert on plant construction, plant repairs and plant layout, SEEKS POST. Good testimonials.—Address, P5861, The Engineer Office. P5861 B

YOUNG ENGINEER, Age 25, 6 Yrs. Shop, 3½ Yrs. technical (2½ friction clutch designing in Paris).—Address, P5856, The Engineer Office. P5856 B

PARTNERSHIPS

CAPITAL AVAILABLE.—BUSINESS PROPOSITIONS, PARTNERSHIPS and MORTGAGES ARRANGED. Private Limited Companies formed. Commission paid for introductions.—Send requirements, "ACCOUNTANT," Reach, Jessell Chambers, Chancery-lane, London, W.C. P5855 C

SMALL PRIVATE COMPANY of GENERAL ENGINEERS REQUIRE ENGINEER with about £2000 capital for expansion of business. Applicant must have had experience in Structural Steel, Boiler Work, Drawing-office, &c. Business is old established and has good prospects; Southern county.—Address P5862, The Engineer Office. P5862 C

For continuation of Small Advertisements see page 4.

A Seven-Day Journal

Two Strange Railway Mishaps.

Two very unusual happenings to railway trains have just been announced in the daily Press, and on each occasion the victim was a French train. In one case two accidents fell to the lot of one train during one journey, and in the other a train was stalled by snails. The Paris–Bordeaux afternoon express had passed Poitiers about ten o'clock in the evening, when the locomotive was derailed. The engine bumped along the permanent way for about a mile and a half, but fortunately the rest of the train kept the metals. It is surprising that the rails should have been sufficiently in gauge to allow the passage of the coaches after the continued derailment of the engine. Anyhow, the train was ultimately brought to a stop with no harm to anyone. A new engine was then provided for the resumption of the journey; but it had not gone far before its boiler exploded. The driver and fireman were killed, but no one else was hurt. The second mishap referred to above reminds us of the stories of trains being stopped by hordes of locusts and caterpillars, but in this case it was snails. A heavily laden goods train was on the way from Casablanca to Kourigha, when the driver noticed that the track was literally covered with snails. For a short distance he was able to proceed, but finally the engine was stopped by the wheels slipping in the sticky mess of crushed snails. It was not until a banking engine had been obtained that it was possible to resume the journey.

Two Coal-Oil Schemes.

IT has just been announced that a plant for the refining and cracking of oil produced by the low-temperature distillation of coal is to be put up on the south bank of the river Humber, at Killingholme, by Petroleum Refineries, Ltd. The site is adjacent to the Admiralty Oil Storage Depôt, and covers an area of 53½ acres. On this area there is already a concrete flat of 11½ acres, which is suitable for the foundation of the new plant, a siding connection with the London and North-Eastern Railway, and three tanks having a total capacity of 4½ million gallons. The property possesses several other facilities, and has the merit that water transport can be used both for the collection of raw materials and the distribution of final products. Another allied project is announced from Sydney, Australia, where a company with a capital of £300,000 has been formed, under the title of the Australian Benzol and Coal Distillation Company, with the object of utilising the Illingworth process of low-temperature carbonisation of coal. A site has been acquired on the shore of Lake MacQuarie, near Newcastle, which also has a frontage on the ocean and is close to a colliery producing coal suitable for the low-temperature process. The supply of coal will be facilitated by an adit, so that winding will be avoided. It is estimated that the new works will produce, from 300 tons of small coal, 215 tons of smokeless fuel, 5100 gallons of crude oil, 1356 gallons of benzol, 4000 lb. of sulphate of ammonia, and 1,500,000 cubic feet of combustible gas.

Nearly Absolute Zero.

ACCORDING to advices from Amsterdam, Professor Keesom, of Leyden University, succeeded on three separate occasions during May in reducing a volume of 200 cc. of liquid helium to a temperature of 0·82 deg. Kelvin. That is to say, very nearly to absolute zero according to the Kelvin scale. No information has yet been published as to the means he employed, but it appears that the liquid was actually maintained at that temperature, as compared with the previous momentary solidification of helium, also in the Leyden laboratory. It is noteworthy that there are only three laboratories equipped for the investigation of temperatures so low as this, and the other two are at Cambridge and Toronto, where some important researches are being carried out.

Steamers *versus* Motor Ships.

AT the annual general meeting of the Nitrate Producers' Steamship Company, Ltd., held in London on Friday, May 24th, Sir John Latta, the chairman of the company, made an interesting statement with regard to the relative performances of steam and oil engine driven vessels in the company's fleet, which is managed by Lawther, Latta and Co., Ltd. He paid tribute to the satisfactory operation of the company's new motor ship the "Anglo-Canadian," which was built last year by Short Brothers, Ltd., and was engined by William Doxford and Sons, Ltd., with a four-cylinder Doxford opposed-piston engine designed to develop about 2250 S.H.P. at 86 r.p.m. The ship has a length of 426ft., and a measurement of 5268 gross tons, with a speed of about 11 knots. The efficiency of the new ship and her adaptabilty were, he said, surprising, and there was less time lost in deviating for and loading fuel; while the baneful consequences of coal of poor quality, so frequently met with in operating steamers, was avoided. Notwithstanding, however, these and other advantages, the company had found that steamers, on present capital values, were more profitable for its purposes. The "Anglo-Canadian" had made a round voyage involving identically the same services in all departments which had recently been fulfilled by the "Anglo-Australian," a steamer of approximately the same gross tonnage and speed, propelled by quadruple-expansion steam engines, built by the North-Eastern Marine Engineering Company, Ltd., of Wallsend, and supplied with 225 lb. pressure superheated steam. The comparison of service was in every way exact, and it had resulted in favour of the steamer. He thought, however, that for higher speeds and when measurement cargoes were available, then the oil engine driven vessel might show an advantage.

A Government Research Inquiry.

THE announcement is made that the Treasury has appointed a Committee to inquire into the functions and organisation of Government research and experimental establishments and to report on the method of recruitment and the conditions of service of the civilian scientific and technical officers engaged in such departments. The establishments included in the scope of the inquiry include those under the Admiralty, the War Office, the Air Ministry, and the Department of Scientific and Industrial Research, also the Departments of the Government Chemist, the Chemical Analysis Department of the Admiralty and the War Office and the Meterological Office. The members of the Committee are Professor H. C. H. Carpenter, F.R.S., chairman; Sir W. J. Larke, K.B.E.; Sir Robert Robertson, K.B.E., F.R.S., Government Chemist; Mr. F. M. Morris, of the Treasury; Mr. R. J. G. C. Patterson, of the War Office; Mr. F. E. Smith, F.R.S., of the Admiralty; Mr. H. T. Tizard, F.R.S., of the Department of Scientific and Industrial Research; and Mr. H. E. Wimperis, M.I.E.E., of the Air Ministry. Mr. H. Brittain, of the Treasury, has been appointed secretary to the Committee.

A New Scottish Bridge.

A NEW bridge on the "Road to the Isles," in Scotland, was opened on the 24th inst., about 2 miles from Fort William. It crosses the river Lochy, and replaces an old suspension bridge which was not strong enough for the requirements of modern traffic. The new bridge is of reinforced concrete, and is, it is said, strong enough to carry any known load for road transport. It is also noteworthy through harmonising with its surroundings. Up to 1849 the crossing of the river was effected by a four-oared ferry, but in that year Lochiel built a suspension bridge to take its place. It now remains to build a new bridge across the Caledonian Canal, and to reconstruct the road to Mallaig to provide an important improvement in the communications of Western Scotland.

Sir Humphry Davy.

THE centenary of the death of Sir Humphry Davy took place this week, and is to be commemorated at Penzance on June 8th—at Penzance, because that was his birthplace. He was born in 1778, and in his early youth he seems to have been rather wayward and careless about his own education. However, at the age of sixteen he was apprenticed to a west country surgeon and applied himself assiduously to the study of physics, making a large number of experiments, principally on gases, notably on "laughing gas," nitrous oxide. In 1801 Count Rumford appointed Davy as Chemical Lecturer at the Royal Institution, and he made a great success of this office. One of his lectures, "Some Chemical Agencies of Electricity," is said to have unravelled the fundamental laws of electro-chemistry, and imported into science a new order of conceptions. He received honours from France, was knighted in 1812, and married a wealthy widow. He then went abroad for some years, taking Faraday as his assistant. Returning to London in 1815, he invented the miner's safety lamp, for which he was presented by the Northumberland coalmasters with a silver dinner service. According to his will, the service was sold at his death, and the proceeds provide the annual Davy Medal of the Royal Society. He continued his travels abroad, but in 1827 had a slight paralytic stroke. In February, 1829, he had another stroke, and died in Geneva on the night of May 28th–29th of that year.

A Trade Union Fusion.

AT a joint meeting of the executive committees of the Transport and General Workers' Union and the Workers' Union, which was held in London on Thursday of last week, May 23rd, it was decided that the proposed amalgamation of the two unions, now that the requisite majority for approval has been obtained from the members of both bodies, should be proceeded with, and the amalgamation take effect on August 5th. Meanwhile, it is arranged that the transfer of engagements with the National Health Insurance approved societies be made on June 30th. The ballot figures show that 169,507 members of the Transport and General Workers' Union voted for amalgamation and 21,094 against, giving a majority in favour of 148,413, while in the Workers' Union 59,801 members voted in favour and 9632 against, giving a majority of 50,169. With a combined membership of about 430,000 the new union will be the largest trade union under a single financial control. It is true that there are over 625,000 members in the Miners' Federation, but that body is in reality a combination of a number of unions possessing independent financial control. Another union with a large membership is the National Union of Railwaymen with 300,000 members, and both the Amalgamated Engineering Union and the Amalgamated Society of Woodworkers are each smaller with 145,000 and 116,000 members respectively.

Sir W. G. Armstrong, Whitworth and Co., Ltd.

AT the recent annual meeting of Sir W. G. Armstrong, Whitworth and Co., Ltd., Mr. J. Frater Taylor, the acting chairman of the company, made reference to the strong financial position which the company enjoys at the beginning of its new era. The company, he said, had interests in Vickers-Armstrongs, Ltd., which firm was in turn intimately connected with the newly formed English Steel Corporation, and there were signs that the benefit arising from that fusion of interests and the economies thereby brought about were beginning to be felt. With regard to the company's own works, embracing the Scotswood Works, the Close Works at Gateshead, and the three Tyne shipyards, more profit could be made by closing down certain of these activities, but the directors were pursuing a deliberate policy of keeping the works going with a view to their eventually being employed to capacity operation. The new chairman of the company, Mr. Frater Taylor, went on to say, would be Major-General G. P. Dawnay, who would take up his duties on June 1st. He would be assisted by Lieut.-Colonel P. D. Ionides, who, as vice-chairman, would give his whole time to the duties in question and would direct new efforts along the lines of building up the company's engineering business by the manufacture of certain standard general engineering plant. The two new companies which now came into being will be known as Sir W. G. Armstrong, Whitworth (Engineers), Ltd., and Sir W. G. Armstrong, Whitworth (Shipbuilders), Ltd.

The London and Home Counties Joint Electricity Authority.

IT is announced that Mr. F. W. Purse, who for the past ten years has been chief engineer and manager of the West Ham Electricity Department, has been appointed Chief Engineer to the London and Home Counties Joint Electricity Authority. Prior to his appointment at West Ham, Mr. Purse held positions at Bristol, Bath and Warrington, and was chief electrical engineer at Watford and Carlisle. He is a Past-president of the Incorporated Municipal Electrical Association and a member of the Council of the Institution of Electrical Engineers, and has acted in an advisory capacity on electrical matters to a large number of local authorities, including the Corporations of the City of London, Doncaster, Guildford, Liverpool, Southwark, Salford, Burnley, Bath, and Barrow, the Hertfordshire and Inverness County Councils, and the Burghs of Port-Glasgow, Gourock, and Inverness.

An Interesting Steamship.

AT the end of last week there was launched from the Scotstoun Yard of the Blythswood Shipbuilding Company, Ltd., Glasgow, the new coal and ore-carrying steamer "Berwindlea," which is being constructed for the Berwindmoor Steamship Company, Ltd., of Liverpool. The ship is of special interest on account of her embodying the latest practice in coal-carrying cargo ship design, and the fact that she is the first steamer to be built in Great Britain which has been specially constructed for the burning of pulverised coal. She has a length of 400ft. with a beam of 52ft. and a depth to the upper deck of 31ft. Her designed speed is 10½ to 11 knots. The propelling machinery comprises a single set of triple-expansion engines built by David Rowan and Co., Ltd., of Glasgow, which is supplied with superheated steam at a working pressure of 200 lb. per square inch from two single-ended boilers designed to work under forced draught. Each boiler has a diameter of 16ft. 6in. and is 12ft. in length, which allows large combustion space. The bunkers are arranged on the hopper system, which enables the coal to be delivered directly to the pulverisers. The whole of the pulverising plant has been designed by Clarke, Chapman and Co., Ltd., and in design it is generally similar to that described in our issue of May 17th. Provision is made for the storage of comparatively small quantities of powdered fuel, and the designed capacity of the pulverising plant is in excess of that required by the boiler furnaces. The hull of the "Berwindlea" has been built on the cantilever system with topside tanks, and it is specially strengthened for the carrying of coal and iron ore. The four cargo holds are served by seven hatches of the Hogg-Carr patented corrugated steel hinged pattern. The whole of the work has been carried out under the supervision of the consulting naval architects and marine engineers, Messrs. Esplen and Sons, of Liverpool.

The Shannon Power Scheme.

No. VI.*

WHEN the partial development scheme is completed there will be sixty-six 38·5-kV sub-stations connected to the 38·5-kV transmission lines. Of these, forty will be equipped with selective protection apparatus

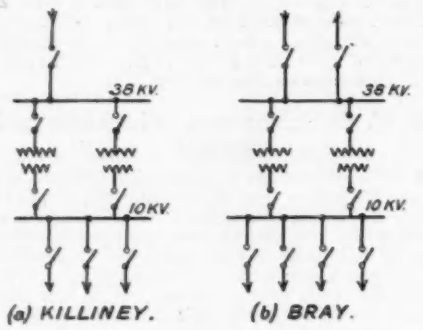


FIG. 54—SUB-STATION ARRANGEMENTS

and the remainder with simple over-load protection. The selective protection apparatus provides that, should a fault occur at any point on the line, the power will be cut off at the two nearest selective protection stations and the remainder of the loop will remain in service. The transformer stations which will intercept the 38-kV lines have now been erected at all the most important towns, so that a 10·5-kV system can run from each of these stations to the various points of local consumption.

* No. V. appeared May 24th.

The 38–10-kV sub-station housing is standardised to such an extent that only the lengths of the buildings vary. The fundamental dimensions of the type A is shown in Fig. 54, and by the addition of cubicles it is constructed up to type F. The types mostly required are C and D, examples of which are at Killiney, type C, and Bray, type D, both being close to Dublin. For the temporary electrification of the lines, inter-connectors from Fleet-street, Dublin, will supply the two above-mentioned stations, and also stations up to Waterford round to Maryborough and back to a temporary station at Inchicore. The houses are built on modern principles, the stresses being taken by a latticed steel framework encased in foundation work, cement blocks and roofing, the finished structure being in harmony with the Irish landscape. The walls are hollow, and the outer plastering is treated with "Pudlo," to prevent the absorption of moisture and to reduce the temperature variations inside the building. For this purpose sarking felt has also been laid underneath the slates. The concrete floors of the Transformer station are painted with "Oxan" oil to make them impermeable, dustproof and non-slippery. The iron wire fencing around each sub-station is set back at a minimum distance of 4 m. from the live parts. The Killiney transformer station viewed from the 38-kV side and showing its two 500-kVA, 37,500/10,000-volt star-star connected outdoor transformers, is shown in Fig. 55. An idea of the electrical arrangements can be obtained from the simplified diagrams of the Killiney sub-station—*a*, Fig. 54—which is tapped off from the line, and the diagram of the Bray sub-station—*b*. By placing the transformers out of doors the building has been considerably simplified, and by the provision of an ample number of isolating switches great facility is given for inspection and repair. The 10-kV transformer connections are brought into the building by means of underground armoured lead-sheathed three-core cable

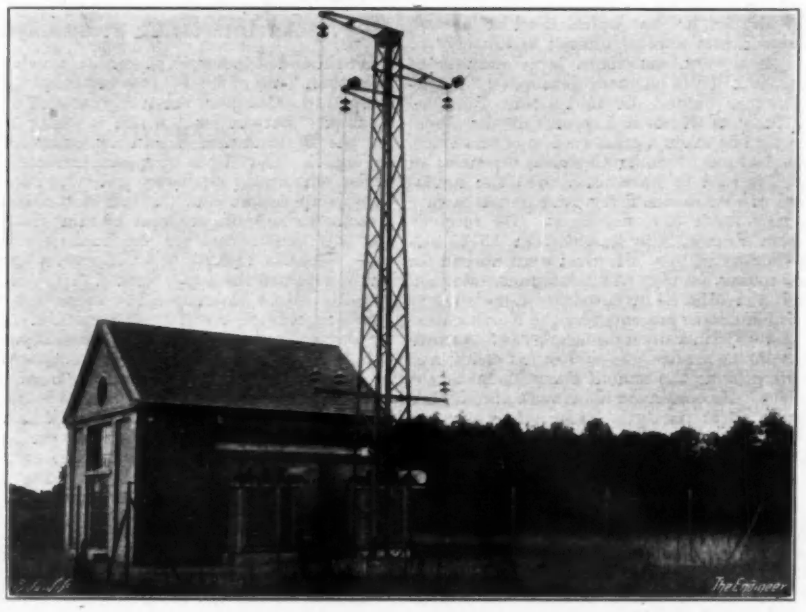


FIG. 55—KILLINEY SUB-STATION

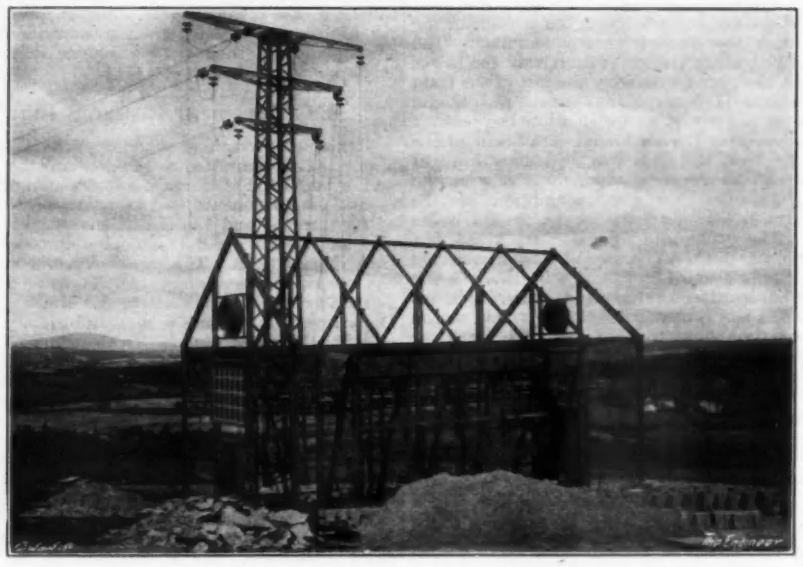


FIG. 56—WEXFORD SUB-STATION IN THE COURSE OF ERECTION

not put out of service until a definite time interval has elapsed. The Buchholz gear is, however, biased so that a larger volume of gas emitted will instantly isolate the transformer and notify this by setting the hooter in action. For every sub-station, earthed choking

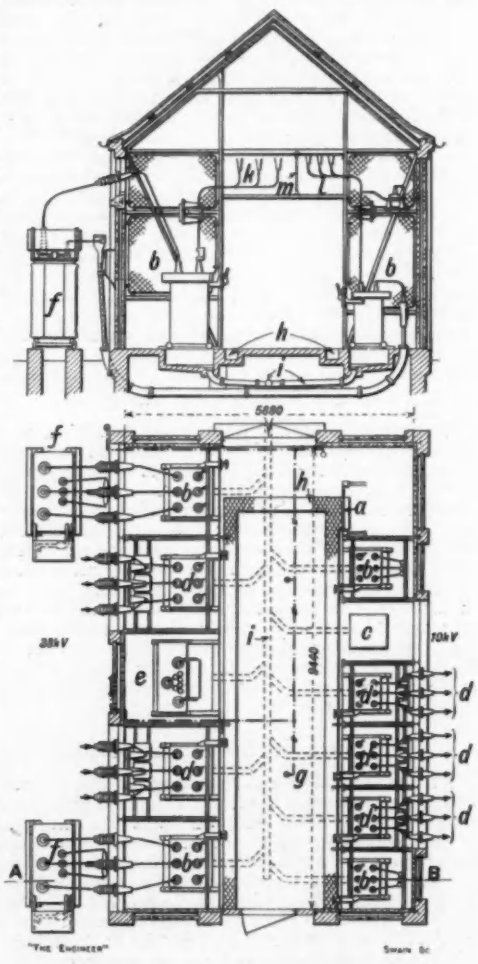


FIG. 57—"D" TYPE SUB-STATION

coils are provided, and feed from secondary windings, the impedance relays, the earth fault relays (which measure line insulation and voltage to earth), and the necessary lighting. A single-phase transformer working in conjunction with a diode rectifier charges a 24-volt battery, which is provided mainly for energising the trip coils of the oil switches. All switching operations are carried out from either side of the central gang-

way, and each circuit is tapped off from the bus-bars overhead—see Fig. 58, which gives a view in the gangway at the Bray sub-station. Fig. 59 also shows the switchgear in the Bray sub-station; Fig. 60 is a view of the 38/10-kV transformer substation at Waterford; Fig. 61 a view of the New Ross sub-station in the course of erection; Fig. 56 the Wexford sub-station in the course of erection; Fig. 63 a F-type sub-station near Maryborough; and Fig. 62 a temporary sub-station at Dublin.

FIG. 58—VIEW OF GANGWAY AT BRAY SUB-STATION

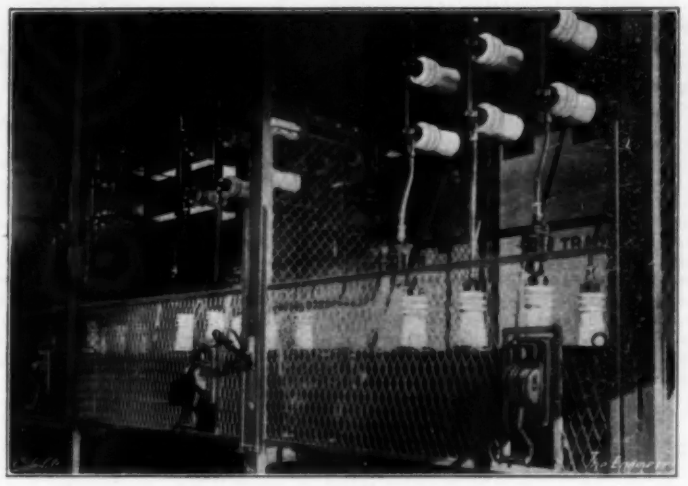


FIG. 59—SWITCHGEAR AT BRAY SUB-STATION

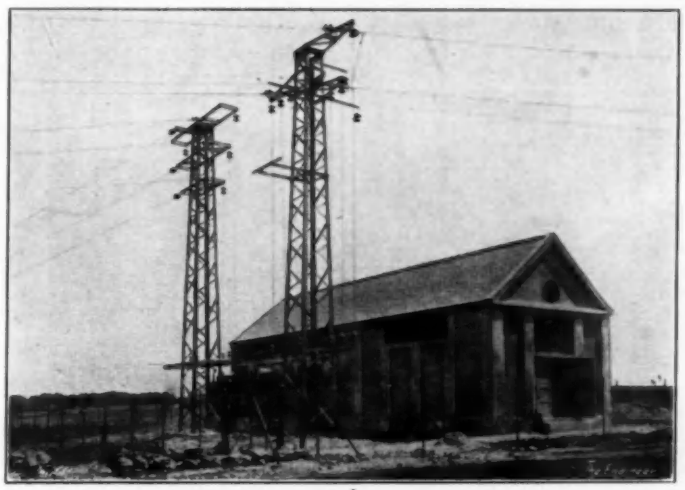


FIG. 60—WATERFORD SUB-STATION

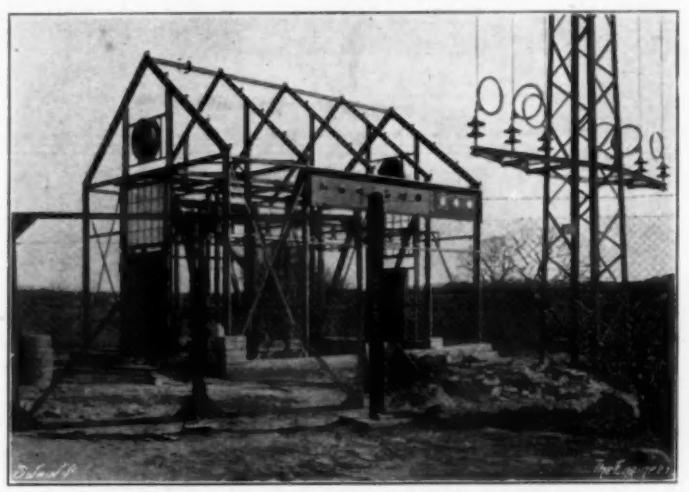


FIG. 61—NEW ROSS SUB-STATION IN COURSE OF ERECTION

A plan and sectional elevation of a D type transformer is given in Fig. 57, in which the arrangement of the circuit breakers on the two sides of the gangway is clearly shown. In this drawing the switchboard is marked *a*; the transformer feeders *b*; the earthed choking coil *c*; the overhead line feeders *d*; a spare compartment *e*; the transformers *f*; the lighting wiring *g*; the cable trench *h*; the oil drain pipes *i*; the 38-kV bus-bars *k*; the 10-kV bus-bars *l*; and the screens between the bus-bars *m*. Each circuit breaker compartment has an oil trough and drain pipe which discharges into a pit outside the building. Concrete-lined trenches covered with checker plates are provided in the floor of the gangway to accommodate the measuring and signalling cables.

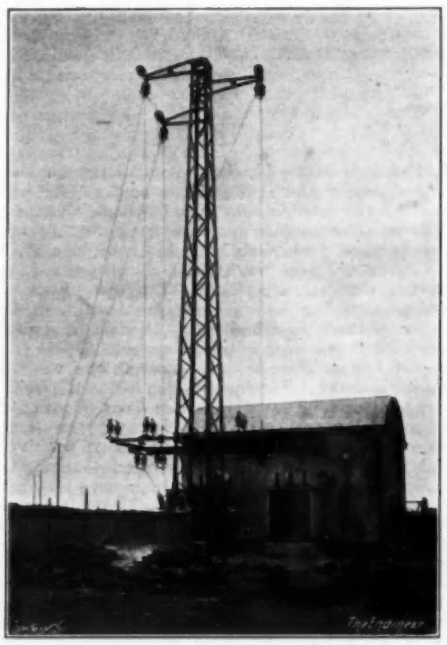


FIG. 62—TEMPORARY SUB-STATION AT DUBLIN

In order that the circuit breakers may be pushed into or drawn out of their compartments, they are mounted on rollers running on rails. Electrical apparatus, such as current transformers, isolating links, &c., for the different feeders are mounted in the respective oil circuit breaker compartments. The transformer stations may be divided into three classes, head stations, through stations and junction stations. The head stations—see diagram *a*, Fig. 64—are erected at the end of a feeder line branched off from the 38-kV overhead transmission network, and they merely serve to transform the pressure from 38 kV to 10 kV, and to supply the 10-kV distribution system. On the 38-kV side these transformers have only one incoming overhead line feeder. The through stations *b* have two 38-kV feeders, and in the event of a short circuit on the line the faulty part of the 38-kV overhead distribution system is cut out without affecting the working of the remainder of the network. For the compensation of the current flowing to earth on the occurrence of a fault, Bauch extinguishing transformers are provided at Dublin, and also in the Ardnacrusha power station, and owing to the provision of these transformers the cutting out of the line owing to an earth fault and the consequent interruption of the supply are avoided. Furthermore, the otherwise heavy earth fault current is reduced practically to zero. The earth fault relays actuate special drop annunciators, which indicate in each sub-station the direction in which the fault has occurred. As we have said, in the case of a fault to earth or in the event of a short circuit, a hooter at the main entrance of the station gives an alarm. The junction stations—*c*, Fig. 64—are equipped in exactly the same manner as the through stations, the only difference being that they take more than two 38-kV lines.

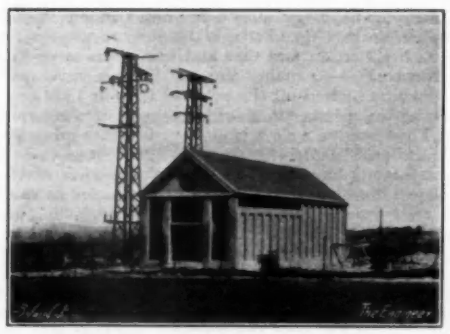


FIG. 63—MARYBOROUGH SUB-STATION

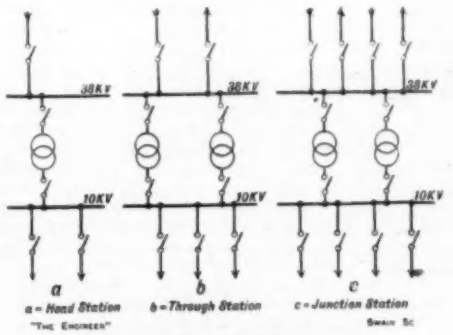


FIG. 64—SUB-STATION CONNECTIONS

All transformers with capacities ranging from 100 to 500 kVA are of the self-cooled core type, with a ratio of 37,500 ± 5 per cent./10,000 volts, and they are connected star-star fashion. The pressure of 37,500 volts with tappings giving ± 5 per cent. was chosen in order to adapt each transformer to the voltage conditions of the 38-kV system, thereby complying with the interchangeability requirements of the Irish Government. By means of a switch on the cover of the transformers the tappings may be brought into use when the transformers are dead. On the higher voltage side the transformers are connected

with oil circuit breakers, isolating links, and with the 38-kV bus-bars by means of copper tubing.

A diagram of connections for a "D" type junction sub-station with two transformers, and two 38-kV overhead line feeders, is given in Fig. 65. One of the incoming lines is shown at *a*; the earth choking coil at *b*; an outgoing line at *c*; the lighting circuit at *d*; the oil switch trip coil at *e*; an overload contact maker with a time lag at *f*; the bi-metal contacts at *g*; the Buchholz protective gear at *h*; the hooter at *i*; the 24-volt battery at *k*; the valve rectifier for charging the battery at *l*; earth fault relays at *m*; drop indicators at *n*; impedance relays at *o*; voltage relays at *q*; and directional power relays at *p*. The low-tension side of the transformers is connected to the oil circuit breakers, isolating links and bus-bar by means of three-core armoured lead-covered cable. One of the 10-kV cable end boxes is fixed to the outside of the building wall, whilst the other is in the 10-kV compartment. The oil circuit breakers for the 38-kV transformers are fitted with H.T. relays, which, when they respond, close a contact and release the tripping gear. On the 10-kV side the transformers are merely provided with trips which are actuated by relays on the 38-kV side. Each transformer is provided with a bi-metal contact relay which causes the circuit breakers to disconnect at a temperature

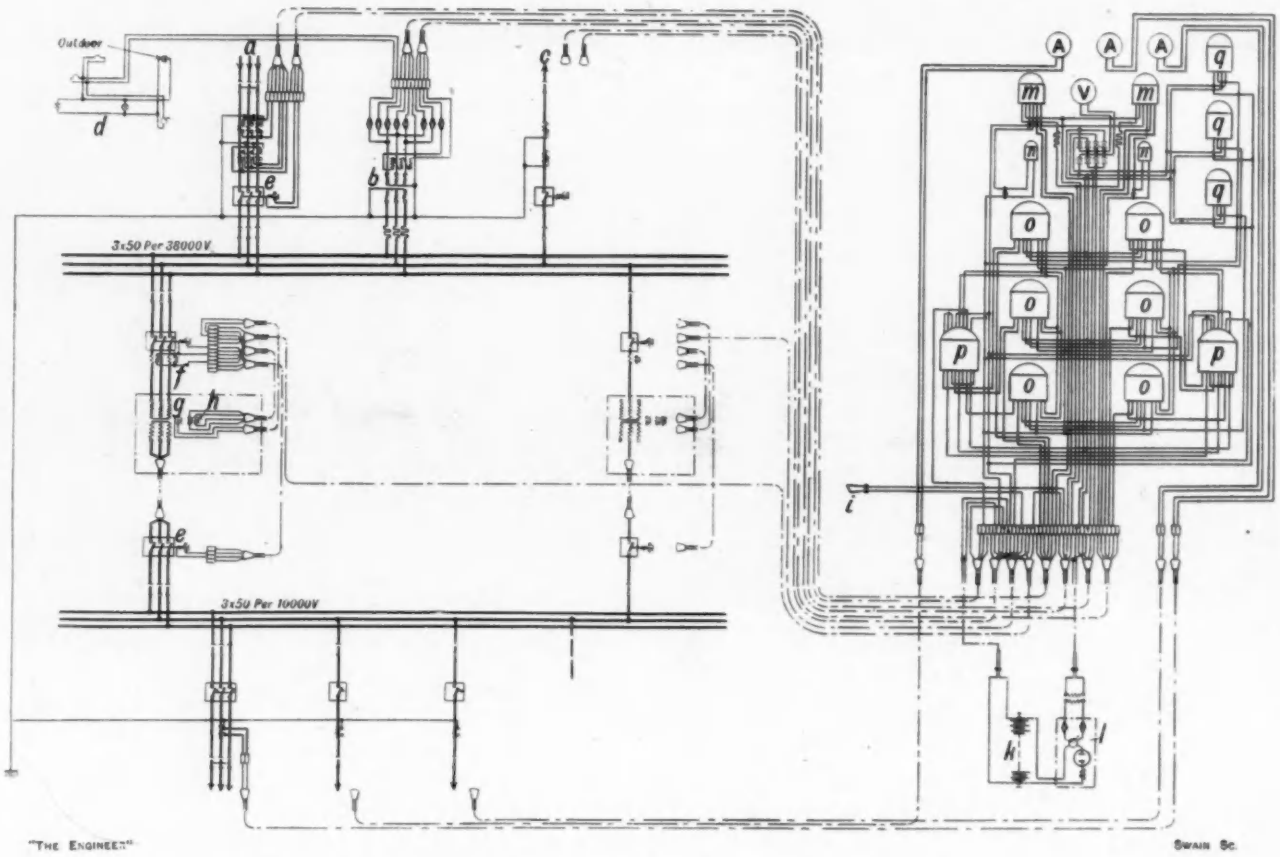


FIG. 65—DIAGRAM OF CONNECTIONS FOR "D" TYPE SUB-STATION

of approximately 90 deg. Cent., thus eliminating the danger of an overload for a long period. In the case of a minor fault, which only gives rise to moderate generation of gases, the Buchholz device simply actuates a hooter, whilst in the case of a dangerous fault, it actuates the circuit breakers and the hooter as well. The oil circuit breakers of the 10-kV overhead lines are provided with "built on" overload time relays, acting on the lock of the tripping gear of the circuit breakers for the purpose of disconnecting the feeders.

(To be continued.)

IN considering the Ministry of Transport railway statistics for February, which have been issued as a Stationery Office publication, price 3s. 6d., it must be remembered that there was an additional day in the corresponding period of 1928. The effect of that was indicated in there being recorded, for the first time during the last three years or more, a reduction in the number of passenger journeys made at reduced fares. The total number of passenger journeys decreased by 5·7 per cent. and the receipts from passengers by 12·3 per cent.; the reduction in passenger train mileage was, however, only 1·7 per cent. The tonnage of merchandise carried fell by 1·63 per cent. It would have been worse but for an increase of over one million tons, or 6·33 per cent., of coal, which also brought in an increase of £349,998, or 11·71 per cent., in receipts. Other merchandise traffic fell, and the net result was a decrease of 6·16 per cent. in the freight train receipts. The saving in freight train mileage was 2·48 per cent. The average train load increased by 2·81 per cent., and the average wagon load by 2·47 tons. The latter figures are due to the increase in coal traffic.

The Rocket.

ONE of the pleasures of having more money than you know what to do with is that you may do things which others with a smaller coefficient of superfluity may or must regard as not worth while. America is the fortunate possessor of several such men, amongst whom is included Mr. Henry Ford. The world thinks of Mr. Ford as a hard-headed very practical business man and nothing more. As a matter of fact, he is a complete American, by which we mean that he has a pronounced sentimental side to his character. Although the most up-to-date man in business that one could meet, it is amongst his ambitions to preserve the records of the past. He has saved old inns and houses from destruction by removing them bodily, and he has opened at Detroit a museum. He is also, we must add, the possessor of a railway, on which the British tradition of beautiful and well-kept rolling stock and locomotives is maintained. It is setting an example to American railways which till now have never paid any attention at all to the appearance of their engines. How far the fact that he is now a railway man is responsible for his desire to acquire a perfect replica of the "Rocket" of Rainhill for his museum, we cannot say; we only know that some months ago he instructed the original builders, Robert Stephenson and Co., Ltd., of Darlington—it used to be R. Stephenson and Co., and the works were then in Newcastle—to make one as like as two peas that which carried off the prize of £500 in 1829.

If, as we are sure it must have been, a pleasure to Mr. Ford to give a *carte blanche* order to Stephensons to build once again—for that is what it came to—the most famous locomotive in history, imagine what a pleasure it must have been to Stephensons to carry out that order. Figure to yourself the bustling and excitement in the office, the hunting up of old drawings and books and manuscripts, the questioning amongst old workpeople about the workshop methods of "Geordy's" day, the consultations with antiquarians of engineering, the arguments and debates about materials, and the anxious research into the great problem of the "Rocket"—her lost fire-box. Such opportunities do not come to a firm once in ten centuries. Museums have built models, replicas of a kind have been made of old machines, but never before, we believe, has an exact duplicate, duplicate as to methods, materials and mistakes, been constructed. It was not an easy thing to do, but it has been done, and it is possible to say, with almost absolute certainty, that the new "Rocket" is so like the first "Rocket" that its own father wouldn't know them apart.

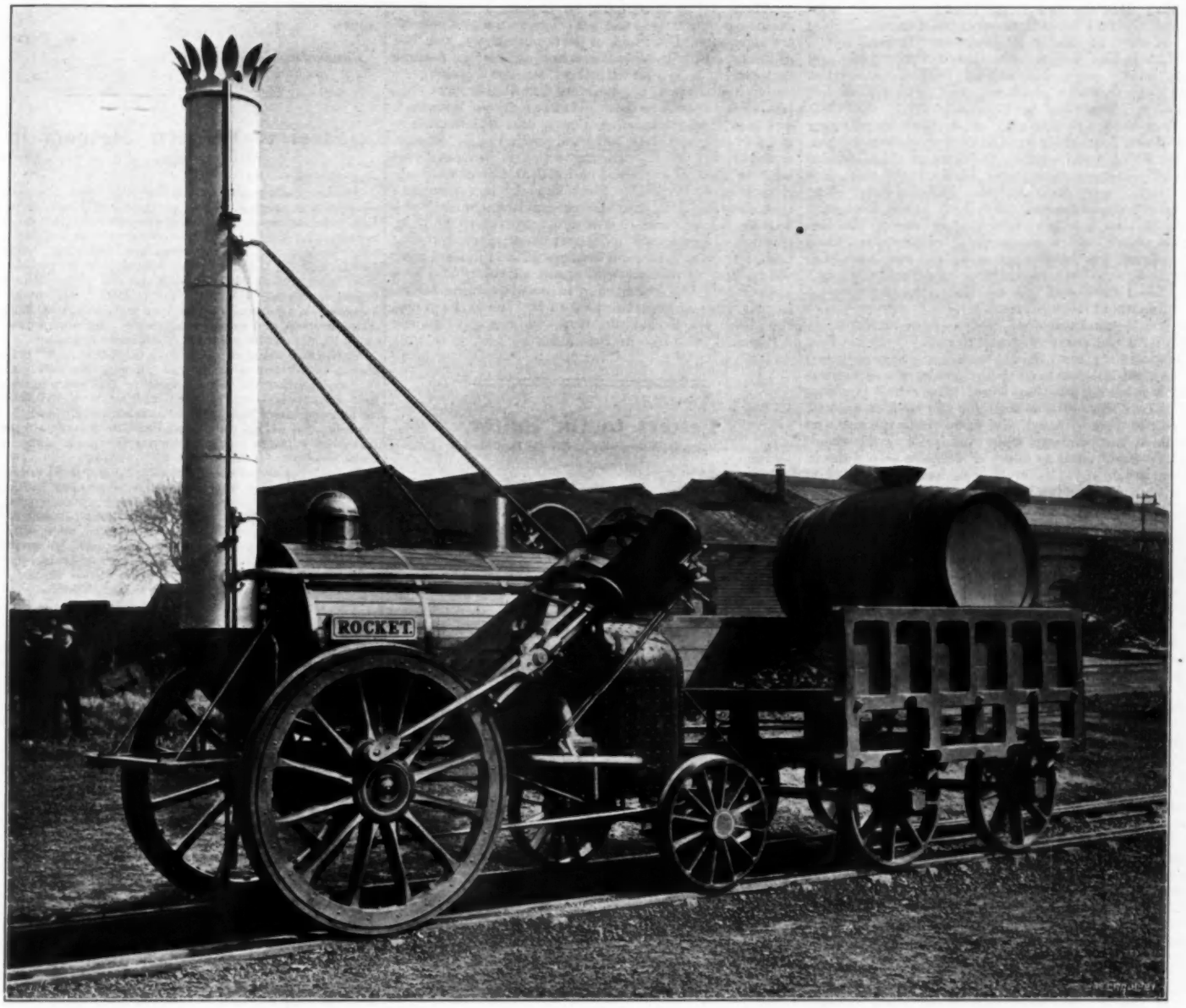
Some days ago we stood beside her with Mr. Goodall and Mr. Galt, in a shed where she was under steam. Just the three of us. Just no doubt, as nearly a hundred years ago, George and Robert and Booth stood beside her. Perhaps the self-same problems that we discussed they had discussed; perhaps even they, too, were conscious of the faults in design which with a hundred years of experience we could see. If only a trial had been in the wind! If only we had been debating of "her" chances and dreading the visits of other Peeping Toms like "Mr. Burstall Junior from Edinburgh" come in to steal our secrets! If only no great railways existed and we had seen visions of a network spreading all over the face of the globe! If these things could have been, then would the spirit of the great three who built "Her" have entered into us and in our little way, and for a little time, we should have been raised to their greatness.

It often happens that when we look at the engines and machines of the past we find ourselves wondering how on earth they did their job. Consider the crude mechanism of windmills and watermills, of cranes and pumps and other devices. Look at the clumsiness of the parts, the unsuitability of the materials, the simplicity or absence of lubrication, the inaccuracies of workmanship. It is a wonder that they did more than turn themselves round, leaving nothing for external useful work. In the Stephensons' time mechanical engineering had emerged from that primitive condition, cylinders could be bored with reasonable accuracy, iron plates were rolled and no longer beaten out under the hammer, the problem of the straight line motion had been solved by the introduction of guide bars, and many methods of manufacture had made remarkable advance since Trevithick built his road locomotive in a country forge and Hedley constructed his "Puffing Bill" at a pit head. But the "Rocket" brought with her several new problems, and the greatest of them was the boiler. It must be remembered that it was new in every respect. Up to that time, and even after it, the internal flue was the common practice. The furnace was inside the boiler, its right place. The Stephensons—and Booth, his part is important—not only replaced the large-diameter flue by a number of tubes of relatively small diameter, but they took the furnace outside the boiler; they introduced the locomotive fire-box. Those were two great changes, pregnant with unknown difficulties. To keep twenty-five 3in. tubes tight against an hydraulic test pressure of 150 or even 120 lb. was no easy matter. It gave them a lot of trouble until, as Robert says in a letter to his father, they "clunk" them in.

What was "clunking"—or should it be "clinking"? Clink means a lot of things, from a famous prison in Southwark up to, by corruption, the clinching of an argument. It may mean tapping, as with a hammer, or it may mean turning over, as the protruding end of a nail. What, in Heaven's name, did Robert mean by it? Did he enlarge the tube ends by driving a taper drift into them, did he expand them by tapping with a hammer, or did he turn the ends over—like a nail—bead them, as we have it now? It is impossible to say. But we do know that finally,

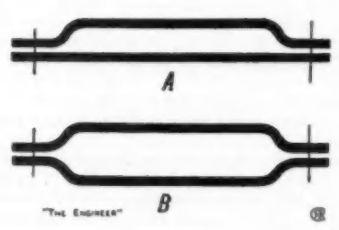
THE "ROCKET" REBUILT

ROBERT STEPHENSON AND CO., LTD., DARLINGTON, ENGINEERS



after screwing, soldering and other efforts, they came to the use of iron ferrules driven tight in. Could that have been clinking ? The new Stephensons have expanded and ferruled the tubes in and made a job of it ; perhaps that was the way of it.

Then the fire-box. The head waggings and the talkings and the pulling about of drawings and books and sketches and the travelling to and fro that that blessed box has entailed ! There was nothing to go by, for, as everyone knows, the "Rocket" of South Kensington was modified out of recognition. Almost it might be said that, like Owen constructing a mastodon from a single bone, so that fire-box had to be reconstructed from a line of rivet holes and a few scratches. It all came about by the position of the water line and the known weight of water which the box ought to contain, with additional complication caused by sketches, in the *Mechanic's Magazine* and elsewhere, showing the back corner boldly champfered off. We know that the fire-box, of copper, was quite separate from the boiler proper, to which it was attached by screws and coupled by circulating pipes. It was pushed up, so to speak, against the back end so that the hot gases might enter the tubes, but otherwise it had a "dry back"—front in a locomotive—and a dry front. In fact, it was nothing but a hollow flat-sided horseshoe with fire-bars across the open end. That sounds easy enough ; but how does one make that sort of thing in 1829 ? That was the rub. Dendy Marshall thought he had settled it. He was fortunate enough to secure Rastrick's note-book, and Rastrick was one of the judges at Rainhill. One would have thought that Rastrick knew all about it, and he actually gave a sketch of the section of the box. It was as shown at A in the little sketch below. But did he really know ? He could only see the inside of the box by peeping in through the fire hole. Even if he had a tallow dip stuck on the end of a stick he would see but little, and the Stephensons may not have courted his investigations. Supposing the cross section of the water space was really like B in the sketch, would he have known ? You can argue both ways about it, but the modern Stephensons "clunk" the argument by measuring the amount of water that the Rastrick section would hold. It wasn't nearly enough. So there was a confabulation at South Kensington, with rules and magnifying glasses, and Warren, of the "Century," and Forward, who knows more about ancient locomotive construction than the rest of the world put together. And there, on the back plate of the old boiler, were two lines of rivet holes. One was all anyhow, the other a neat regular curve, just what one would want for the attachment of the curved crown of the fire-box. That seemed to settle one point at least. It gave the position of the fire-box relatively to the back plate.



The position of the water line, fairly easily determinable, did the rest, and Forward plumped, though it differs from his own "reconstruction" for the South Kensington model—with all the arguments on his side—for the double ogee section. It fitted the rivet holes, it gave the right water level, and it gave the right amount of water. May the ghosts of George and Robert never return to shake our confidence in the decision of their descendants !

Well, that settled the form of the box and so it was made—hammered out by a copper smith from a copper sheet and riveted together by hand—and so it was tried. Now it is known that the boiler end of the box was protected by fire-bricks, but there was no record of bricks being used at the footplate end ; nothing there but a thin iron plate. The coke fire played the deuce with that ; it made it red hot and scorched the unfortunate driver off his precarious platform. In any case that was not the place to be uncomfortable on. You had to have all your wits about you to drive the "Rocket" at all, and if whilst you were trying to do so you felt that, like an ancient martyr, you were slowly being consumed by fire from the feet upwards, some mistake with the tricky gear might occur, or you might momentarily lose your hold of the horizontal valve rod, your only means of adhesion to the engine, and fall off the footplate. Something had to be done about it, and it was fortunately discovered from old records that Stephenson ordered a lot of fire-bricks, too many for the two or three square feet at the front end. What could be easier to believe than that he wanted them for the back end as well ; and so a wall was built there and the situation was saved.

In mechanical invention nothing ever happens just as you expect. Until a thing has been made and tried it is unsafe to say that it will work—or won't. Sometimes surprising success ensues, sometimes the least probable thing goes wrong. When one looks at the "Rocket" as she ran triumphantly at Rainhill and projects oneself backwards into the excitement of those October days, the heart comes into the mouth. Will she stay the course ? Will the boiler burst, the seams open, the chimney fall, or the cylinders break bodily away from their doubtful hold upon the boiler ? What a dreadful position, to our modern eyes, those cylinders are in ! Not dreadful because of their inclination, though that offends us, but because they seem to be floating in the air, and at every stroke they wrench themselves to and fro, straining at the two stays and the few bolts which hold their entablatures to the flimsy fabric of the boiler. Look at the end view as it is given on page 595 ; remember that the cylinders are 5ft. 7½in. centre to centre ; notice the total absence of adequate support, and then ask yourself would you like to stand on a narrow footplate hurtling through the air at nearly thirty miles an hour with your nose just between

them. The prize well won, the Stephensons must have been glad enough to get their engine safely home and set about considering how to tie those cylinders more firmly to their base, though they appear to have been left where they were for many months. Mr. Goodall thinks that is why they were lowered to the almost horizontal position which they now occupy at South Kensington. It was not a flash of genius which anticipated the future and broke boldly from the almost traditional vertical or steeply inclined positions, but the impulse of necessity. They *had* to be made fast; that was the first need. It was easy to do that by bringing them down from their exalted but precarious height. Earlier Stephenson engines, the famous "Lancashire Witch" amongst them, had inclined cylinders, but they were not designed for high speeds. The 'Rocket" was different. We shall never know the truth of the matter. Down they came, and an engine which had a transcendent mechanical fault —you must see it to appreciate it—not only was improved out of recognition mechanically, but established once and for all the right attitude of the cylinders of locomotives.

It is a remarkable fact, not without significance, that of all the parts of the "Rockets" the driving wheels were the best. Seeing them now, reconstructed with a rigid adherence to the originals, one recognises what a splendid job they were. The crank pin boss was of cast iron with sockets for the wooden spokes, the felloes were of wood, and upon them the tire was shrunk in the ordinary way. So far it is all wheelwright's work, such as many of us have seen done in village smithies. The craft was hundreds of years older than locomotive building; the wheels of highway coaches were wonderful products. Hence the Stephensons had no difficulty in finding men with the acquired knowledge of centuries to build their driving wheels for them. Another tire with tread and flange had to be shrunk on over the wheel tire and pinned upon the wheels. It was of wrought iron. Was it turned up in position on the axles and was the inner tire also skimmed up before the outer was put on? These are problems not yet solved.

The trailing wheels are of cast iron with quite straight spokes. There was an idea that they had chilled treads, but no one could cast such a wheel in a chill; the spokes would have to be curved for the sake of flexibility to take up the cooling strains.

The "Rocket" runs like a motor car and calls for some of the same driving skill, which her new driver, inspired perhaps by the shade of Dewrance, has quickly acquired. Reversing is a tricky business. The gab rods have to be lifted off their pins, a pedal has to be pressed, and the gabs have to be dropped again upon their pins, all in proper sequence. It takes a little learning. It will be remembered that the "Rocket" had—let us say "has," for she lives again in her new incarnation—but two excentrics, one for each cylinder. These two excentrics are fixed firmly upon a sleeve in the right relative position to each other. On each side of them, keyed to the shaft, is a dog clutch. By pressing the foot on a pedal, kept up by the long U-shaped spring seen in the footplate end view, the sleeve can be moved out of engagement with both these clutches. In this position, after releasing the gabs, the driver takes the two valve levers in his hands and works them in proper unison until the engine starts to move in the desired direction. He then drops the gabs into position and either releases the foot lever, so that the sleeve is pushed back by the spring, and the excentrics lock themselves in one position which they have automatically taken up, or depresses it till a notch engages with the footplate and the excentrics are fixed in the other position by the other dog.

Going back to the boiler for one moment. It will be remembered that the Rainhill "Rocket" had no smokebox in the proper sense of the word. That came later. As well shown by the photograph which is reproduced on page 593, the base of the chimney was bell-mouthed out to cover the ends of the tubes, and the two blast pipes, one from each cylinder, entered the lower part at either side. Later they were combined into one with marked effect.

The photograph also shows another interesting thing. The level strip over which the trials were run was a straight mile and a half long with an eighth of a mile at each end in which to get up speed. The engines ran backwards and forwards, pulling their trains in one direction and pushing them in the other. Hence there was no need for a front buffer beam and it was omitted, though the framework to carry it was there. Subsequently a buffer beam was added.

The long U tube beside the chimney is the mercury pressure gauge. In the extended limb a wooden rod floats in the mercury and the upper end of it slides over a white board marked with the pressure.

The tender speaks for itself; a beautiful job with the horn plates and axle-boxes looking almost too good to be true. It is interesting, again, to notice the difference between the design of the woodwork—there were lots of expert cart builders—and the ironwork. The latter seems to be feeling its way—note the number of stays—whilst the former was quite confident. The total absence of brakes is rather curious; one would have expected to find them on the tender at least. How did she stop when she ran light at 29½ miles per hour, just to show what could be done?

One always thinks of old engines and boilers as lagged with polished mahogany. Often enough it wasn't real mahogany at all, just paint, and in the "Rocket" it seems to be pretty certain that the boiler was lagged with pine or deal painted green.

When one is developing an engine or machine it builds up under the hand. You can't make a general arrangement. Drawings of parts may be got out, but in the assembly modifications and alterations become necessary. So it was with the "Rocket"; she grew under the hands of her builders and no complete contemporary drawing exists. There are lots of drawings, but they were made subsequently and after modifications of this and that had been carried out. At last, however, we have a drawing which is probably just what it would have been had the Stephensons made it soon after Rainhill. More thought has gone into that drawing than into the general arrangement of a modern engine, and it is a delight to us to be able, through the courtesy of Robert Stephenson and Co., Ltd., to put it before our readers. Now, indeed, may the makers of models rejoice and all those who love locomotives find something to pore over for hours. At last, through the fine spirit of Mr. Henry Ford and the devotion of the old firm, we know what the "Rocket" was like at Rainhill. L. P.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

132,000-VOLT CABLES.

SIR,—The importance of this subject, coupled with the scepticism in some quarters as to the reliability of 132,000-volt cables, leads me to crave some further space in your columns for developing this subject.

(1) The amount spent on the New York installation, allowing for the duplicate cables necessary to put it on a par with our ideas over here as regards standby capacity, was £1·475 per kilowatt per mile transmitted. This was a fancy price, owing to the novelty of the installation, and would now be only of the order of, say, £0·22 per kilowatt per mile—in the case of Batterses, 15 miles by 300,000 kW by £0·22 = £990,000. (The difference between American and British initiative is illustrated by the readiness with which our American friends will find eight times the sum of money for an experiment.)

(2) The initial transmission, it is well, however, to remember, would be only some 150,000 kW, and would cost perhaps only £660,000, with a very much higher proportion of spare cables than in New York.

(*a*) It might be some three years before developments in the growth of load made the next installation necessary. During these three years it may be taken as absolutely certain that any trifling improvements found desirable will have been introduced, and will appear in the second lot of cables.

(*b*) As regards causes of weakness in the cables, those of us who have for the last five years followed with unremitting and laborious attention the developments of paper-insulated cables, know quite well that, having now entirely dropped non-radial electro-static fields, there only remained the questions of voids in the cable due to expansion and the change of power factor and of capacitance due to heating. The latter has now been experimented on and tested, till we have reached a point where nobody would dare to hint that we do not know all we should learn by waiting.

(*c*) The question of voids is recognised by those best qualified to judge as completely met by the pressure oil filled type of cable. The only factor not yet tested by experience "in the field" is the effect of expansion and contraction below ground, whether due to tropical heat or to Arctic cold or to superincumbent loads; perhaps also due to external vibration. This can be met by greater depth of laying. These difficulties could all be met by slinging cables against embankment walls on both sides of the river, high enough to be clear of the mud, and yet low enough to be always covered by the water, and with suitable provision for lifting joints for repairs.

(*d*) The expansion due to temperature caused by the current can be met by giving the cables a conservative rating, remembering that the heating goes down as the square of the load, and a conservative rating is not therefore expensive.

(3) Another point that must be borne in mind is that it is inconceivable that all the cables—if laid in different routes—should go down suddenly; and in this sense we are taking very little greater risks than with generating plant units. What trifling extra risk there is can be met by the provision of a rather greater proportion of spare plant in cables than in generators—say, double the amount. As the £660,000 mentioned includes the equivalent of four spare generator units, it surely will not be contended that this is insufficient. A small extra sum would give a still greater protection, but is not considered necessary. In any case, a cable unit is replaceable in very much less time than a generator unit.

(4) Have I not made it clear that from the engineer's point of view there is no risk of interruption of the supply?

(5) From the financier's point of view, the £660,000 will always be worth £330,000 if the cables are used at 66,000 volts, and the financial risk is, therefore, in the limit £330,000, and this is extremely remote.

What is £300,000 to a scheme of the size of Batterses, compared with Britain losing the pre-eminent position in the world for cables and the world's markets for 132,000-volt cables?

It would pay the C.M.A. to take this risk and to offer to put in British 132,000-volt cables on a ten-year guarantee, rather than lose the world's market for tens of millions of pounds for super-tension cables in the near future.

A. M. TAYLOR.

Birmingham, May 27th.

Steel *v.* Wooden Sleepers in Rhodesia.

AN interesting comparison between steel and wooden sleepers was recently made by the Chief Engineer of the Rhodesia Railways. The steel sleepers now used on those railways, he states, are of two sorts—(*a*) the pea-pod type, with pressed-out lug and steel key fastening, weighing 70 lb.; and (*b*) the new type, weighing 90 lb. per sleeper, with bolts and washers clipping the rail. The latter type began to replace the old type in 1921. The main line standard is fourteen sleepers per rail length of 33ft., or 2240 sleepers per mile. Practically the entire track is of 60 lb. flat-bottomed rails of different types.

Hardwood sleepers were first introduced in 1919 on the section between Beira and Umtali. Several varieties of local hardwoods were placed in the road untreated, and cannot be said to have proved very satisfactory, as in most cases decay set in comparatively early. The average life of an untreated local hardwood sleeper of the most suitable varieties cannot be taken higher than eight years, as far as is known at present.

In 1923, certain experimentally treated local hardwood first-grade sleepers were put in the road near Bulawayo, and some similar sleepers of an inferior grade, containing part sapwood, but also treated, were laid between Gwaai and Dett. On a recent inspection—*i.e.*, after some six years in the road—these sleepers were found to be entirely sound and free from decay, except in the sapwood in some cases, and they had suffered very little indeed from mechanical abrasion or from serious splitting.

The treatment of hardwood sleepers on a large scale, consisting of soaking in a hot arsenic solution and then dipping in hot tar, began in 1926. In the light of the somewhat limited experience up to the present, it is considered that sixteen years will prove a conservative estimate of the life of these treated wooden sleepers. In the case of steel sleepers, it appears probable that with the present traffic, the utmost limit that can be given as the life of the latest type steel sleeper is twenty-five years on the main line.

The wooden sleepers tried were of several varieties—Rhodesian teak (Baikaiea Plurijuga), Galati, Masanda, Pauga Pauga and Muklambera from Portuguese East Africa—their botanical classification is unknown. The weight of a local hardwood sleeper is round about 140 lb., the dimensions being 6ft. 6in. by 10in. by 5in. The cost of treating is about 6d. per sleeper.

At present the average cost per mile of the new type steel sleeper is £1172, and that of the treated hardwood sleepers £1072. These figures include fastenings, freight and overhead charges. Allowing for interest at 6 per cent. per annum, and for rates of depreciation based upon their assumed relative lives, the comparative costs, neglecting residual values, per mile per annum of steel and wooden sleepers are as follows:—Treated hardwood sleepers, interest at 6 per cent., £64 6s. 5d.; depreciation, £66 7s. 6d.; total cost per mile per annum, £130 13s. 11d. New type steel sleepers, interest at 6 per cent., £70 6s. 5d.; depreciation, £46 17s. 7d.; total cost per mile per annum, £117 4s.

The average cost per mile per annum of wooden sleepers on these railways is therefore at present estimated at £13 9s. 11d. higher than the cost of steel sleepers, and thus on the basis of the annual cost only, the comparison is in favour of the steel sleeper. This condition, the Chief Engineer points out, would hold as long as the prices of the two types of sleeper remained at their respective present levels, and as long as traffic requirements continued to be sufficiently well served by the comparatively light track given by 60 lb. rails on 90 lb. steel sleepers. Extra weight in the track could, he adds, be obtained by the use of heavier steel sleepers, but the extent to which that could be done is slight before the point is reached where they would exceed the cost of wooden sleepers.

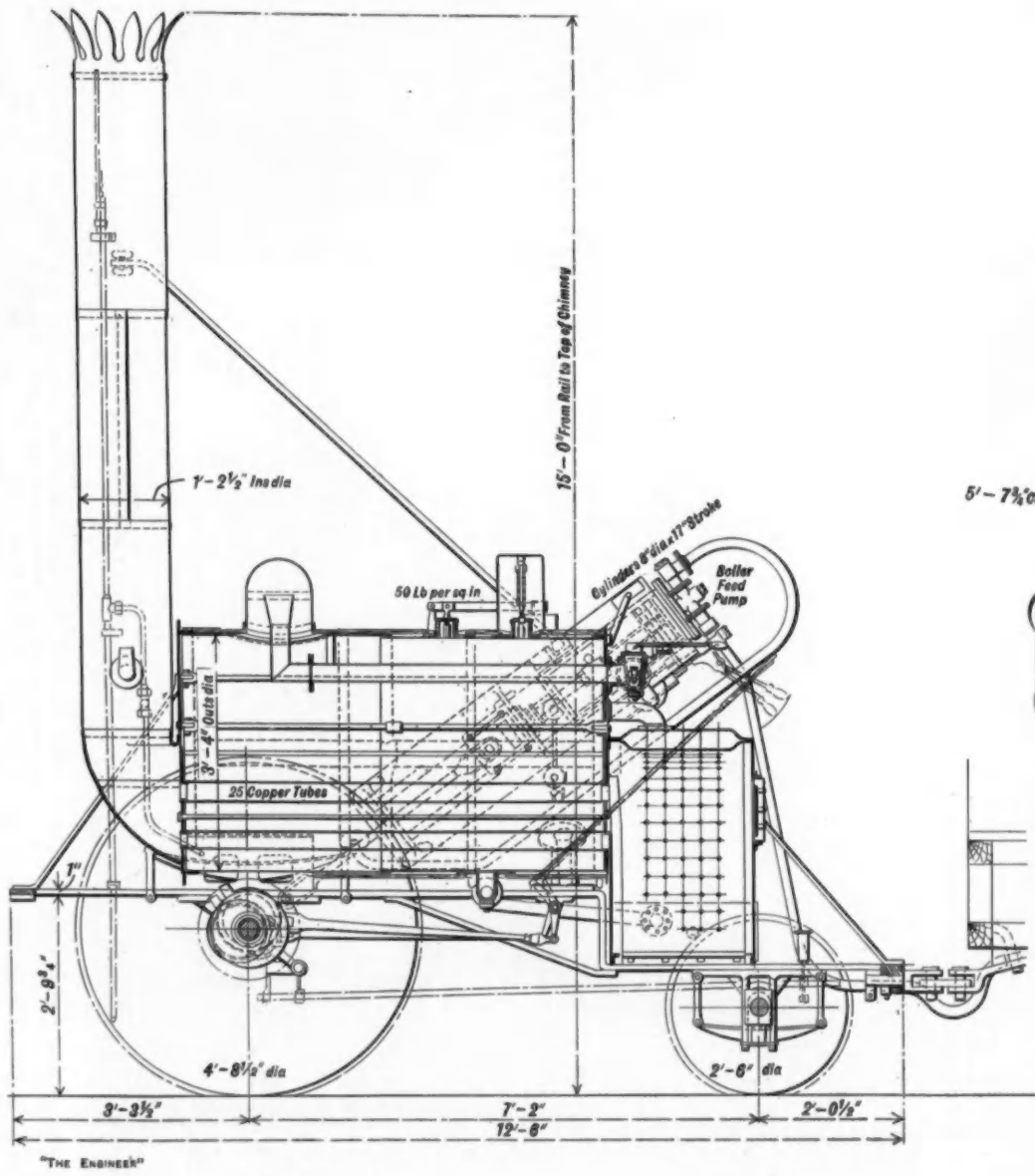
The policy of the railways in choice of the two types of sleepers for renewals is to use local hardwood treated sleepers of approved varieties to the extent that they can be bought without forcing up their price beyond that at which they can be considered as competing with the existing 90 lb. steel sleepers. The balance of the requirements is being made up with steel sleepers imported from England. Provided annual cost is more or less equal, the railway authorities are disposed to favour treated local hardwoods, because (*a*) it leaves the door open to economical relaying with 80 lb. rails at some future date within the life of the sleepers, the present rails being 60 lb.; (*b*) the 60 lb. track being already highly stressed with axle loads running up to 13½ long tons, it is considered that the heavy 140 lb. wooden sleeper makes a more solid road in combination with the 60 lb. rail than a 90 lb. steel sleeper; (*c*) it makes a quieter road for passenger traffic in stone ballast, with which the main lines are being ballasted; (*d*) it assists in the development of what bids fair to become an important local industry; and (*e*) it keeps money in the country.

THE Niagara Parks Commission proposes to make application to the Parliament of Canada during the present or next session for an Act granting authority to erect, construct or acquire by purchase, lease or otherwise, a highway traffic bridge over the Niagara River. The proposed Niagara Bridge, it has been stated, would involve an expenditure of approximately 6,000,000 dollars to 7,000,000 dollars, and its construction would employ 1000 men for a period of two years.

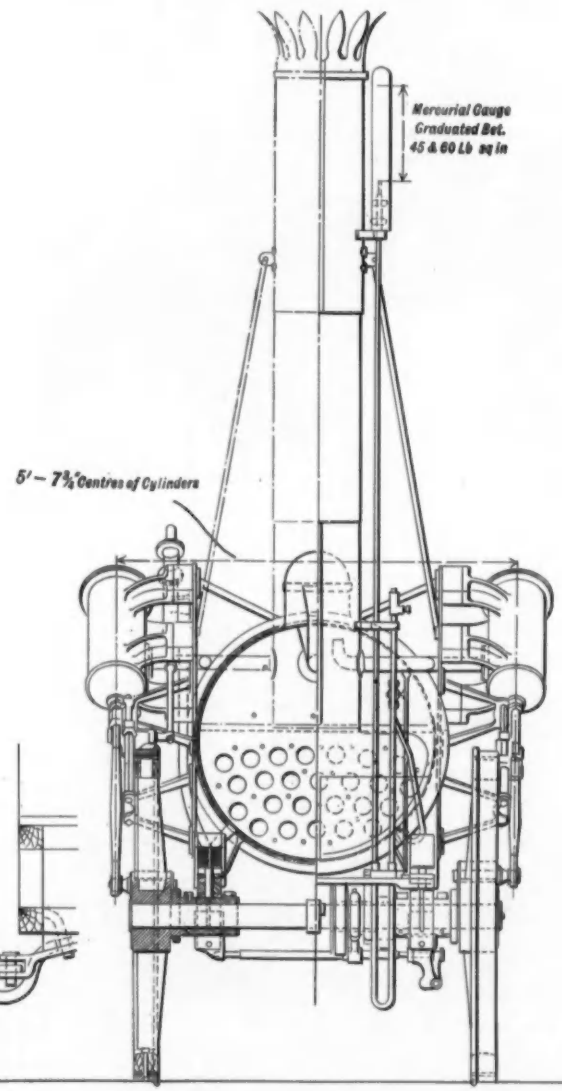
THE RECONSTRUCTED "ROCKET" OF RAINHILL

ROBERT STEPHENSON AND CO., LTD., DARLINGTON, ENGINEERS

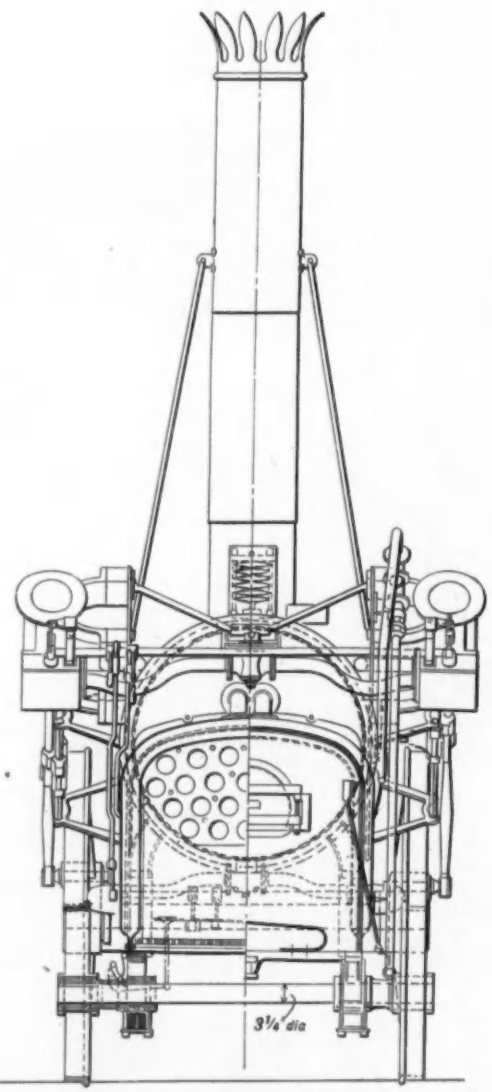
(*For description see opposite page*)



"THE ENGINEER"



VIEW LOOKING ON FRONT OF ENGINE



VIEW LOOKING ON BACK OF ENGINE

North-East Coast Exhibition.

No. III.*

BELOW we continue our description of the apparatus and machinery to be seen in the Palace of Engineering at the North-East Coast Exhibition.

G. AND J. WEIR, LTD.

One of the largest groups of marine auxiliary machinery and pumping plant is to be found on the stand of G. and J. Weir, Ltd., of Cathcart, Glasgow, which firm is exhibiting jointly with the allied firm of Drysdale and Co., Ltd., of Yoker, Glasgow.

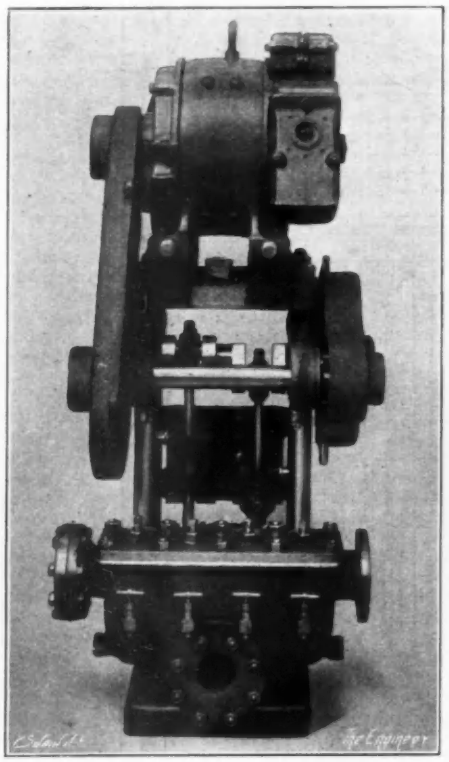


FIG. 22—TWO-THROW POWER PUMP—WEIR

From the fifteen or more items which form the firm's total exhibit we have chosen four for more detailed mention. The first two are examples of boiler feed pumps and are shown in Figs. 20 and 21 respectively. Fig. 20 shows a pair of standard direct-acting feed pumps with a float tank and automatic regulating gear. In general marine practice, it is customary to design the output of each pump to meet the full feed duties required, so as to give a complete standby unit.

The example illustrated comprises a pair of 9½in. diameter steam cylinders with 7in. diameter pump cylinders, the common stroke being 21in. The valve arrangement consists of two suction connections, one from the float tank and the other from the feed heater, with four discharge valves. There is a quadruple steam valve with two single exhaust valves. The supply of steam to the pumps is automatically regulated by the balanced float gear, which will be seen between the two pumps. It consists essentially of a float chamber or hotwell tank in which is suspended the float pan with an open top, but with a water-tight bottom and sides. The float is suspended on two levers, which are so disposed as to give a parallel motion. The bottom lever spindle is balanced by a lever and weight, to which lever is attached a further rod that actuates the control valve supplying steam to the pumps.

In Fig. 21 is shown a typical turbo-feed pump of Weir design. This pump is one of a series of seven different sizes embracing outputs from 7000 up to 50,000 gallons of water per hour. The example we illustrate has a designed output of 20,000 gallons per hour delivered against pressures up to 350 lb. per square inch. The steam turbine is designed to utilise superheated steam at pressures up to 300 lb. per square inch, and is an impulse machine with one pressure stage and several velocity stages. It is coupled directly to a single-stage pump of special design, and, as will be seen from the engraving, the turbine casing and the main bearings are divided horizontally in such a way that the lower parts form the base of the set. At one end the base-plate is enlarged to form a flange to which the pump casing is bolted. This arrangement is one which gives good accessibility to the pump and also the impeller which is carried on an extension of the turbine shaft.

The emergency governor is of the excentric ring type, and in case of the speed increasing beyond that for which the turbine was designed it shuts off the steam supply. In order to regulate the amount of steam supplied to the turbine, a hydraulic governor operating on a double-beat balanced throttle valve placed between the main stop valve and the nozzle box of the turbine.

Another type of feed pump shown is the "Electro-feeder" pump, which consists of an electrically-operated multi-stage turbine pump mounted on a common bed-plate with its motor. The example shown is designed to deliver 20,000 gallons of water per hour against a pressure of 400 lb. per square inch, and the running speed is 1450 revolutions per minute.

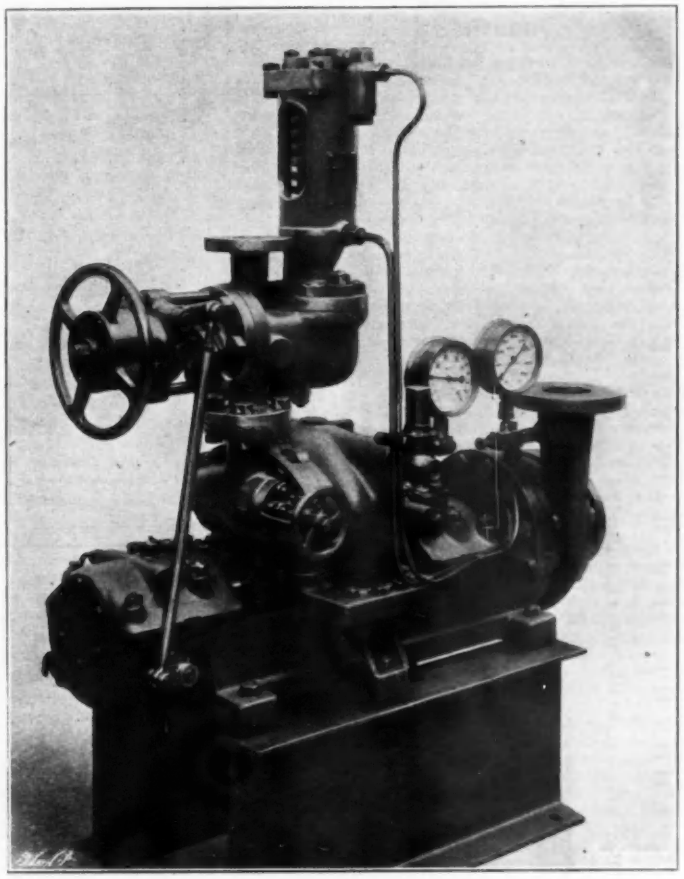


FIG. 21—STEAM-TURBINE-DRIVEN FEED PUMP—WEIR

General service pumps and other power pumps for ship duty are represented by two examples of electrically driven two-throw pumps of the type shown in Fig. 22. The particular pump we illustrate is the smaller of the two exhibits, which has 4in. diameter pump cylinders with a 4½in. stroke, and is designed to deliver 4250 gallons of water against a head of 80 lb. per square inch when running at 100 revolutions per minute. The larger pump is of similar construction, but it has 7in. diameter cylinders with a stroke of 7½in., and its duty is 16,300 gallons per minute against 80ft. head when running at 75 revolutions per minute. The motors are mounted over the pumps and drive them through double-reduction gearing. The cross-head gear is supported on robust steel columns, and above the pump base is the valve chest with the discharge-box and suction branches. Similar pumps may be utilised for various duties aboard ship, including the pumping of salt and fresh water and lubricating and fuel oil. Other fuel pumps exhibited include a horizontal oil fuel pressure pump and a service pump; also a cargo oil pump with 16in. and 25in. cylinders and a stroke of 28in. This pump is designed to deliver 300 tons of oil per hour at thirty-four double strokes per minute, and is suitable for discharging against a

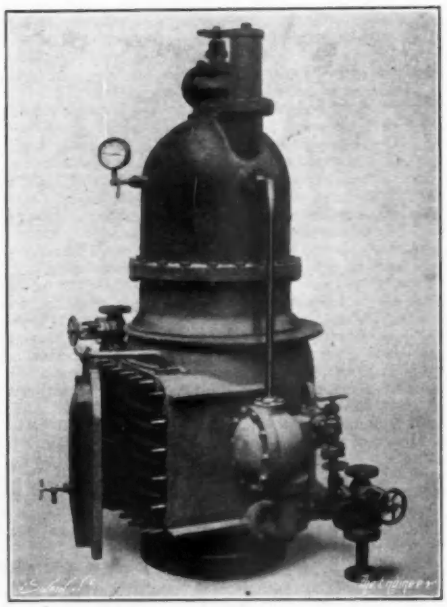


FIG. 23—10-TON MARINE EVAPORATOR—WEIR

* No. II. appeared May 24th.

head of 250 lb. per square inch, the working steam pressure being 180 lb. per square inch. It is of the horizontal type and the steam cylinder is fitted with standard Weir valve gear.

A prominent exhibit is the 10-ton evaporator shown in Fig. 23. The generating chamber and steam dome of the evaporator are of cast iron, and the heating surface is formed by coils of solid-drawn copper tubes which are accommodated in the base of the evaporator. Access to the tubes for purposes of inspection is given by an easily removable swing door. The tube space within the evaporator is separated from the steam space by a special deflector, which allows the steam to rise, but throws down any water and returns it to the water space. A brine ejector with a ball-type automatic feed regulator and check valve form part of the equipment.

Examples of the Weir-Contraflow boiler feed regulator, the Weir-Multiflow feed heater, as well as a Weir-Hydrokineter with a stop valve are also on view. Air pumps are represented by a 16in. by 9in. by 12in. Monotype air pump and a steam ejector air pump designed to maintain any vacuum up to 28·8in. of mercury with a 30in. barometer. The high-pressure air compressors manufactured by the firm are represented by a 11¼in. by 7in. three-stage compressor which is designed to deliver 120 cubic feet of free air per minute at a final pressure of 1000 lb. per square inch when running at 385 revolutions per minute. The compressor is driven by a 60 B.H.P. motor to which it is directly coupled

A selection of Weir-Monel metal products is also to be seen on the stand.

"MONITOR" SAFETY DEVICES.

Special devices for safeguarding the flow of cooling water and lubricating oil in circuits, which are

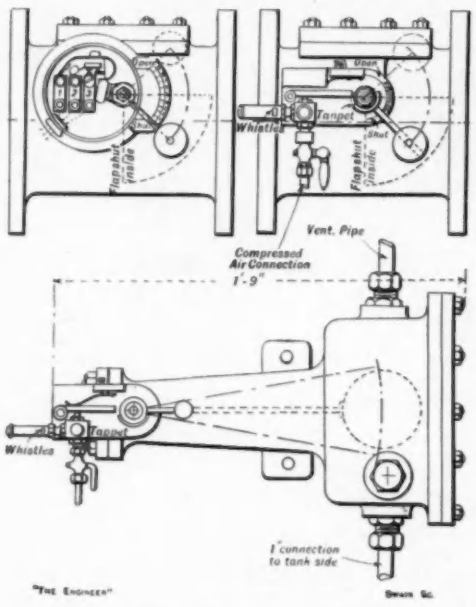


FIG. 24—FLOW AND LEVEL INDICATORS—"MONITOR"

the invention of Mr. C. L. Stokoe and shown on the stand of the "Monitor" Patent Safety Devices, of Wallsend-on-Tyne, are illustrated in Figs. 24 and 25. In the flow indicator shown in Fig. 24, the device

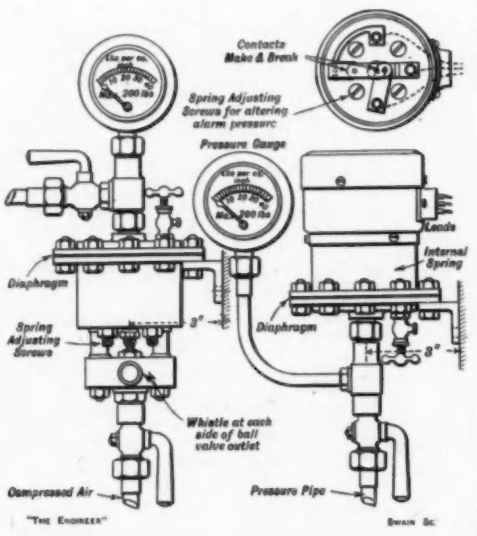


FIG. 25—PRESSURE INDICATORS—"MONITOR"

forms a part of the pipe line, and the flow of the liquid serves to keep open an internal flap or disc valve, the amount of opening being dependent upon the velocity of flow. The position of the flap is indicated externally on a balance lever arm on the flow indicator dial. As shown to the right of Fig. 24 the alarm device may take the form of a whistle operated by means of a tappet on the end of the indicator spindle, which presses on to a ball valve lever as soon as the flow of liquid ceases, and sounds the alarm whistle. The latter is operated by low-pressure air, obtained, in the case of motor vessels, from one of the ship's air systems. This fitting can make for either vertical or horizontal pipes and is designed to reset itself automatically immediately the flow of liquid is resumed. The same device arranged for electrical operation is shown on the left of Fig. 24. It is identical in general construction, but the hinged members carry contacts for the "make" and "break" circuits. The electrical connections are enclosed by a glass cover plate, and the device can be arranged either to give an audible alarm signal or to shut down the plant as soon as the flow of liquid fails. The firm also supplies a modified type of flow indicator, which shows the amount of liquid passing in either tons or gallons per hour. This meter is intended for spot reading, and for simplification the alarm gear is omitted. In the same illustration we show at the foot one of the new Monitor flash alarms, which are designed for use with oil fuel tanks. The apparatus consists of a cast iron box in which there is a hinged float, and an external alarm gear, either of the whistle or electric type, which is brought into operation when the level of oil in the tank becomes either too high or too low. Such a device effectually prevents the overflow of oil tanks on board ship by giving a warning when the tank is nearly full; alternatively, it may also be employed to call the attention of the engineer to the falling level in a tank from which an oil supply is being taken.

Fig. 25 illustrates two different types of pressure alarms, which are worked on the diaphragm principle and may incorporate either whistle or electrical alarms, as shown in the right and left-hand views respectively. The alarm device in this case is operated by pressure, as distinct from velocity of flow, and is intended to be employed for safeguarding forced lubrication systems or cooling water systems, in which it is important to note any sudden drop in the working pressure.

These devices have been fitted to oil engines and air compressors working under marine and land conditions, and can be specially designed to meet a wide range of applications.

THE WALLSEND SLIPWAY AND ENGINEERING COMPANY, LTD.

The various exhibits which are to be seen on the stand of the Wallsend Slipway and Engineering Company, Ltd., relate principally to oil-burning equipment. For the larger part, the apparatus displayed illustrates the Wallsend-Howden patented pressure system of oil fuel burning. The general principles upon which this system works are already familiar to our readers. Visitors to the stand will find interest in the varied arrangements of oil pumps, oil heaters, strainers and burners, and the different types of furnace fronts employed for natural and forced draught working. The detailed construction of the oil heater and the burners is well shown by specially sectioned parts.

A typical pressure unit complete with its horizontal pump, oil heater, and discharge strainer, is shown in Fig. 26. The oil fuel pump is of the "Weir" horizontal "Simplex" type, and it will be seen that the U tube heater is fixed above the pump with the usual

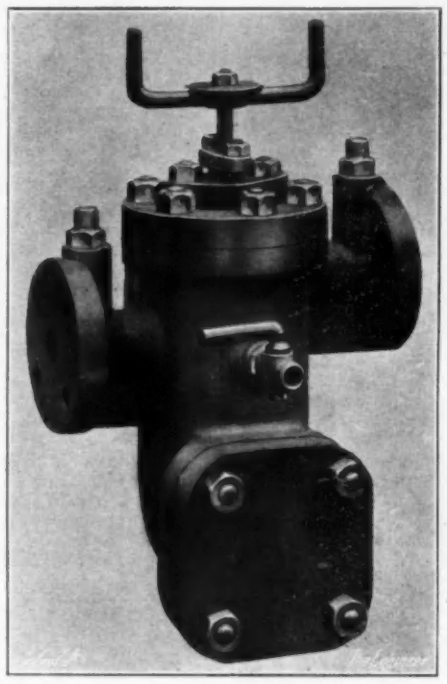


FIG. 27—"AUTO-KLEAN" OIL STRAINER—WALLSEND

gauge and strainer attachments, the whole plant being mounted upon an oil-tight tray. When this type of unit is employed two similar units are usually installed, so that a standby plant is always available. The unit shown in Fig. 26 is connected to two different types of furnaces, one of the natural draught type with a hinged air director to give easy access to the furnace, and the other a furnace designed for forced draught

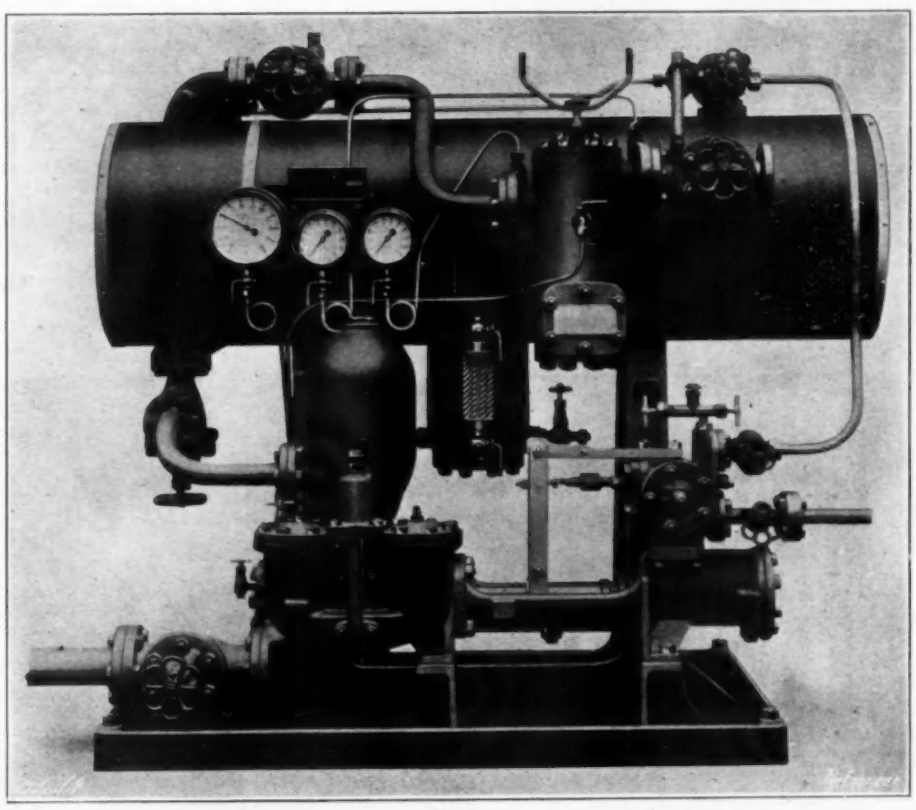


FIG. 26—OIL HEATING AND PUMPING UNIT—WALLSEND.

working which will enable either coal or oil to be used without modifying the furnace front. With this type of front it is possible to convert the furnaces at sea from coal to oil burning or the reverse with the boilers under steam. An alternative form of oil heating and pumping unit is a duplex plant comprising two horizontal oil heaters and two vertical pumps arranged over a single oil-tight tray. This type of plant is generally fitted when space is limited, since it

avoids the use of two separate plants, but gives the same standby facilities.

The firm has adopted the "Auto-Klean" type of oil strainer as a standard fitting, and one of these fittings is shown in Fig. 27. The principle upon which

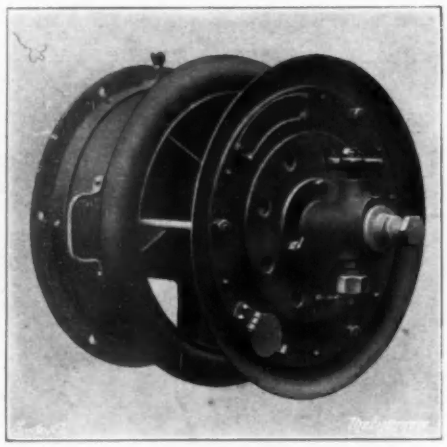


FIG. 28—OIL FUEL BURNER—WALLSEND

the apparatus operates is, it will be recalled, that of edge straining, which is effected by employing a pile of thin steel discs mounted upon a central spindle and interleaved with stationary cleaning blades. When the pile is rotated, by turning the handle at the top of the strainer, any dirt or sediment which may

FIG. 29—LOW-AIR-PRESSURE BURNER—WALLSEND

have collected upon the outside edges of the discs is wiped off and falls into the sump forming part of the main case in which the straining cartridge is housed. A test cock as well as pressure gauge connections at the inlet and outlet flanges are provided. The strainer casing is furnished with a removable door for cleaning out the sump. The Wallsend pressure system has been successfully employed for large outputs and the range of output of each burner may be as small as 90 lb. of oil per hour or as high as over 4500 lb. of oil per hour. A regulated pressure burner for the large output of over two tons of oil per hour, just referred to, is shown on the stand. By means of a sliding sleeve which opens or closes on annular series of angled holes supplying the oil to the burner nozzle the burner output can be varied from 700 lb. to 4500 lb. per hour without having to change either the burner nozzle or diaphragm. For maximum outputs under natural draught conditions, furnace equipment comprising two burners and air directors per furnace has been designed, and such a furnace front is exhibited. The single-burner furnace front of the same type is illustrated in Fig. 28. It will be seen that there are two concentric trunks with vanes fitted into the annular space between them. The sliding sleeve can be adjusted so that it controls accurately the amount of air which is admitted to the furnace, while the position of the flame within the furnace can be varied by opening or closing the louvres on the front plate, which throws back or brings forward the flame as may be desired.

Another type of oil burning equipment is illustrated in Figs. 29 and 30. This is a special burner designed to work with low air pressures of from 9in. to 25in. water gauge. The air used to atomise the oil is generally supplied by a small electrically-driven blower. This type of plant is shown fitted to a ship's galley—see Fig. 30—and also a rivet heating furnace. It is also used for land and marine boilers, central heating, and industrial furnace work, and the range of such burners extends from the smallest with outputs of 7 lb. of oil per hour to burners of 2000 lb. of oil per hour capacity. This apparatus is illustrated by a complete low-pressure air installation comprising a gravity feed tank, strainer and steam heater, together with an electric heater with an automatic temperature control arrangement and a blower and air-preheater.

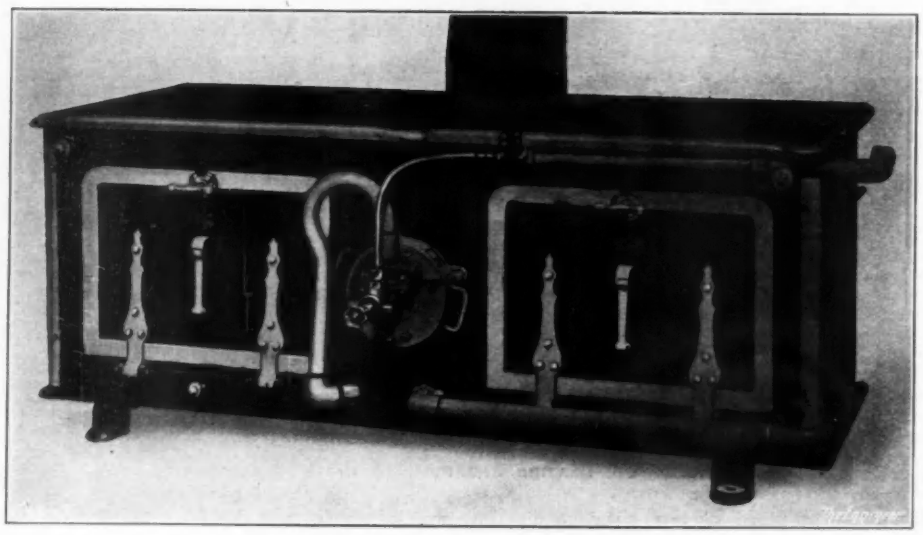


FIG. 30—OIL-FIRED SHIPS' GALLEY—WALLSEND

SUNDERLAND FORGE AND ENGINEERING COMPANY, LTD.

Although the original purpose for which the Sunderland Forge and Engineering Company, Ltd., of Sunderland, was founded, namely, to supply ship's forgings, such as stern frames, rudders, propeller shafts, stem bars and other constructional parts, is still served by an important section of the company's Pallion works, at which special facilities for quick forging repair work are provided, the exhibits shown by this firm are mainly representative of its activities in the design and manufacture of electrical machinery and fittings for ships and for colliery uses.

For close upon thirty-three years attention has been given by the firm to the production of ships' electrical generating plant, along with deck and engine-room auxiliary machinery, while alongside such apparatus mining machinery has also been developed, which is represented on the stand by electrically-driven coal cutters, a vibratory screen and various examples of colliery switch gear and junction-boxes. The larger exhibits include two electrically-driven winches, one of which is shown in Fig. 31. The winch illustrated has a centre barrel and two warping ends, and it is driven by a 33 B.H.P. 275 r.p.m. water-tight motor through worm gearing. The designed lift is 3 tons at a speed of 120ft. per minute, 1¼ tons at 250ft. per minute, and a speed of 480ft. per minute under free hook conditions. It will be seen that two brakes are fitted, one of which is hand-

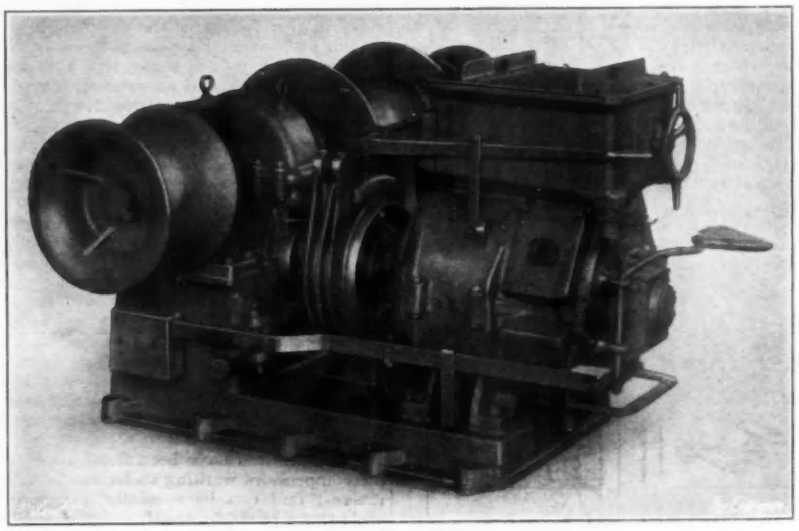


FIG. 31—3-TON ELECTRICALLY-DRIVEN CARGO WINCH—SUNDERLAND

operated while the other is worked by a foot pedal. There is a neat form of swing seat for the operator, who has the switch control handle immediately before him, with an uninterrupted view of all operations. The control gear is of the contactor type, and is usually placed in a deck-house. The other winch is generally similar in type and output, but is fitted with two brakes, one magnetic and the other operated by the foot. A shipyard winch of the electrically-driven worm geared type, designed to lift 3 tons at 45ft. per minute, is also shown, and this machine is fitted with a water-tight controller, having a weather proof resistance. One barrel and one warping end, with a foot-operated brake, are provided. A friction hoist with a continuously running motor and patented reversing gear is also on view, and is designed to lift half a ton at a speed of 200ft. per minute. The electric generating sets include a series of small steam engine-driven units of both open and enclosed types, with designed outputs ranging from 4 kW up to 21 kW. In the larger exhibits there are two 100-kW generators specially designed for directly coupling to oil engines, which are 220-volt machines running at 300 r.p.m. Other groups of machinery include drip-proof motors from 4 to 40 B.H.P., motor generator sets, a windlass control gear, and various starting and control panels. The whole of the exhibits are pleasingly grouped on a single large stand and some of them are shown in operation.

(To be continued.)

AT a recent meeting of the Royal Meteorological Society Mr. R. Ashworth submitted a paper on "The Influence of Smoke and Hot Gases from Factory Chimneys on Rainfall." In the course of this lecture the author stated that in a manufacturing town, such as Rochdale, the combustion of large quantities of coal must produce an upward current of hot air which is probably sufficient to influence the rainfall. That effect was, he said, not likely to be a large one, but it seemed to be a real one from these considerations. (1) The average rainfall on week-days over the long period of thirty years is found to be 6 per cent. more than the average on Sundays. At Stonyhurst, where factories do not predominate, the rainfall on Sundays and week-days is more nearly alike than at Rochdale. (2) A continuous record of rainfall hour by hour shows that there are more hours of rain during the working hours of the day on week-days than on Sundays. Also on week-days the rainy hours are more in the daytime than in the night, the reverse of which occurs on Sundays, and at Stonyhurst on all days, as is generally the case at western stations. (3) The rate at which rain falls is decidedly greater on week-days than on Sundays. It is small on Sundays and increases until mid-week, after which it slightly diminishes. This variation of the rate at which rain falls agrees very closely with the fluctuation of smoke emission as tested by the average number of soot particles deposited from the air each day of the week.

Railway and Road Matters.

PULLMAN cars form a regular feature on some section or other of each of the grouped railways, except the Great Western. That exception is now about to be overcome, as the cars will shortly be put on the Ocean Mails from Plymouth and between Paddington and Torquay.

THE *rapide* which left Paris for Bordeaux on the evening of Friday, May 24th, was stopped beyond Poictiers through its front wheels leaving the rails and running on the sleepers for a considerable distance. Another locomotive was despatched to take on the train, and immediately beyond Ruffec there was an explosion, the engine being completely wrecked and the driver and fireman killed. The train slowed down and stopped without causing injury to passengers.

IT is announced that Mr. F. A. Campion, the chief engineer of the Great Northern (Ireland), will retire on July 1st, on reaching the age limit, and will be succeeded by Mr. G. B. Howden, the Edinburgh district engineer, London and North-Eastern Railway. Mr. Campion joined the Great Northern (of England) under the late Mr. Richard Johnson, and also served under Mr. Johnson's successor, the late Mr. Alexander Ross, and became assistant engineer to that company, which position he resigned when he went to Ireland in 1910. His father was the engineer of the southern division of the Midland Railway.

AN official statement on the subject of privately owned railway wagons has been issued by Sir Ralph Wedgwood, the chairman of the railway general managers' conference. It is to the effect that some little time ago a committee, under the chairmanship of Sir Arthur Duckham, was set up by the Government to inquire into various questions affecting mineral transport. The report of this committee is, it is believed, nearing completion. The use of privately owned wagons and the adoption of high-capacity wagons are subjects which will, it is understood, be dealt with in this report, and any remarks with regard to these subjects made by the railway companies would be premature, pending the publication of the report. It may also be noted that, speaking in the City on May 16th, the Prime Minister said that it would be unwise of him to make any detailed proposals as to the action to be taken until the Government had received the report in question.

THE question of the all-steel coach again arose in the Doe Hill collision of February 12th, upon which Lieut.-Colonel Anderson reported, as mentioned in this column on May 10th. The third and fourth vehicles on the Scottish express were of this make. The first of them was completely broken up by being telescoped for about 30ft. with the one behind. Colonel Anderson observed that, although that might be taken as indicating that all-steel stock was not as desirable as had been supposed, that was not really the case. If they had had wooden bodies they would have been as completely destroyed as the two six-wheeled vans in front of them. The absence of serious damage to the stock in rear of the all-steel vans was, in fact, a striking example of their resisting power in case of collision. It may be added that the speed of the express when it struck head on the standing goods train was 40 miles per hour.

THERE was on January 6th last, as reported in this column of our issue of January 18th, an unfortunate mishap on the London, Midland and Scottish Railway at Bispham, near Blackpool. The accident was the collapse of two girders which spanned the railway, and were part of a light lattice girder structure that was to carry a belt conveyor between a clay pit on one side of the line and some brickworks on the other. The girders were of extremely light construction, and each weighed about 2½ tons. The structure was being erected by contractors, at the cost of the owners of the brickworks, and the railway company was only, in principle, responsible for the safety of the traffic whilst the work near the railway was in hand. For that, all suitable safety precautions were taken. A passenger train had to pass about 10.40 a.m., and all was made clear for it. Workmen were, however, moving about on the girders, and, just as the train passed, the girder on the Bispham side, apparently toppled outwards, and was caught by the fifth coach of the train and swept off its trestle, taking the other, or Blackpool, girder with it. Three of the contractors' men who were working on the girders died later from their injuries. Colonel Trench, who inquired into the accident, concludes that the evidence draws attention to the importance of a definite specification in connection with engineering materials and works.

THE Returns of Accidents and Casualties, as reported by British railways during 1928, were issued on May 23rd, as a Stationery Office publication, price 1s. They show that forty-eight passengers and fifteen servants were killed in train accidents, and 201 servants in "movement" accidents. The total number of persons killed on the railway was 460, which is about the normal record. In addition, there were 377 cases in which trespassers were killed or persons committed suicide. The numbers (246) of collisions of every kind and of passenger and freight train derailments (229) were lower than in any of the previous four years for which the figures are given. The record as to locomotive and rolling stock failures of every kind (143) is slightly lower than in other years, but the failures of couplings (7760) is less than in even the unusually slack year of 1926. Broken rails (149) also were fewer. Although the number of cases of flooding and of slips (83) is less than one-half that of the uncommonly wet year of 1927, it is higher than the 78 of 1924, 50 of 1925, and 29 of 1926. There were in 1928 30 such instances on the London, Midland and Scottish and 37 on the Southern. The wagon coupling failures (5929) compared with 7444 in 1927. The reduction was mainly in the breakages of drawbars or hooks. They were brought down from 4591 to 3484, and there was also a reduction from 997 to 695 in wagons becoming unhooked. There were 168 instances of trains running into gates or vehicles at level crossings, as against 149 in 1927, and two servants and nine "other persons" killed as compared with one servant and seven "other persons" in 1927. Out of 213 servants killed by trains in 1928, 80 were permanent way men.

Notes and Memoranda.

EVIDENCE given before the United States Supreme Court states that the diversion of Lake Michigan water into the Chicago River for sewage purposes can be entirely stopped by the end of 1934.

THE steamship "Berwindlea," which was launched at Scotstoun on May 23rd, is claimed to be the first vessel specially built with machinery for burning pulverised coal. She is of 8000 tons deadweight, 400ft. length, 52ft. beam, and 31ft. depth.

WEIGHING 47 tons, a boiler built by the North-Eastern Marine Engineering Company, Ltd., Sunderland, for the new works of the Duffield Iron Corporation, Ltd., at Adderbury, Oxfordshire, was too large for transit by rail, and is being transported by road. In order to clear numerous bridges *en route* it will have to be repeatedly lowered on to low bogie wheels, and the journey to Oxfordshire is expected to occupy three weeks.

A SWEDISH engineer, Ragnar Blomquist, has, it is reported from Stockholm, invented an entirely new type of pontoon for salvage purposes, which is said to be far easier to handle than the old type. The new pontoon is collapsible and can be folded together and thus easily transported and sunk into the water, where it is unfolded to its natural size and filled with air through a tube leading to the compressor of the salvage ship. The new invention has been patented in all seafaring countries.

STOCKHOLM homes are to have illuminated street numbers this year. Electrical experts have been asked to draw up plans for the necessary wiring, and the municipal authorities are expected to act upon them in the near future. Compulsory illumination of house numbers has been suggested in Stockholm before, but it was not until city doctors and cabmen began complaining of the difficulty of finding the right house number after dark that a vigorous campaign for lighted numbers was begun.

AT the North-East Station of the Kansas City Power and Light Company, there have been installed two boilers, each capable of delivering 200,000 lb. of steam per hour and designed for a maximum pressure of 1400 lb. per square inch. It is claimed that the difference in investment costs of this high-pressure installation and of an installation for 300 lb. pressure is surprisingly small. The fuel saving resulting from the use of the higher pressure is nearly three times the fixed charges on the increased investment.

ACCORDING to an article by Herr F. Rapatz, in a recent issue of *Zeitschrift für Metallkunde*, the brittleness produced in a steel by hardening at too high a temperature is due to the presence of oxygen. According to him a thoroughly deoxidised steel shows no signs of brittleness, even after quenching from a temperature well above the normal. Oxygen also causes the formation of white spots in the fracture of hardened steel. Nitrogen in small quantities has, he says, little effect on the properties of steel, but in conjunction with sufficient carbon it tends to increase the hardness of the surface.

THERE was great expansion in imports of machinery into India during the year 1928, the total value being 18 crores of rupees, against 15½ crores of rupees for the previous year, while as compared with 1926 the increase was 33 per cent. The expansion was due to two facts: first, the reduction, in some cases the total abolition, of import duties; and secondly, increased industrial activity. About 16 crores worth of machinery was received from the United Kingdom, against 12 crores the previous year. Germany's share increased from 99 lakhs to 116 lakhs and that of the United States from 161 lakhs to 190 lakhs. The total value of electrical imports during the year, both machinery and instruments, was 531 lakhs, against 482 lakhs for the previous year. Imports of wireless apparatus rose during the year from 11½ lakhs to 16½ lakhs.

AN insidious form of wastage of heating surfaces is mentioned in a recent official report on a "boiler" explosion. The subject was an economiser, made of cast iron tubes, and the tubes had obviously wasted away on the exterior to an extent of about $\frac{1}{8}$in. The internal wastage was, however, considerable, and in the vicinity of the fracture the minimum thickness of good metal was $\frac{1}{4}$in., but varying to a maximum of $\frac{3}{4}$in. The deterioration was of the nature known as a graphitic wastage, which is not readily noticed by the eye, as a feature of this defect is that the material usually retains its original form and appearance. Unless the wastage was at the upper end of the pipes it would not be readily detected. In this case the wastage was most severe at the lower end, and it is not surprising that it escaped notice at periodical examinations.

IN the course of a lecture before the Oil and Colour Chemists' Association, Mr. F. Fancutt said that paints for railway carriages must be elastic and remain so for the maximum period. The strains and stresses occurring during the working of railway carriages were unlike those met with on any other types of transportation vehicles, but the greatest evil was moisture, atmospheric and from the daily cleaning. The use of long-oil paints and varnishes, therefore, would be further appreciated. Furthermore, all stopping and bedding materials must contain the maximum amounts of oil and gums to obtain complete watertightness. For that reason it had been the practice to paint the inside of the body with long-oil paints containing red lead, and in some cases acid-resisting paints, and those had been fairly successful under certain conditions. Experiments, however, had recently been conducted by the L.M.S. Railway with emulsified bitumen solutions, and although it was too early to form a reliable and definite opinion the indications were that they might prove more effective. Whilst the use of nitrocellulose finishes had increased during the past few years on railways, at the moment clear wood finishes were, nearly entirely, being used. The pigmented type of finish had not proved successful on railway carriages, chiefly owing to the number of mouldings and projections on the body work, and at the moment it is the view of Mr. Fancutt that the true type of pigmented cellulose finish is not suitable for railway carriage painting because of the stresses occurring during the movement of the vehicles at high speed.

Miscellanea.

THE new motor lifeboat for Padstow, which was launched at Cowes on the 22nd inst., is said to be the largest of its kind in the world.

THE tenders for the new electricity supply plant for Umtali, South Africa, amount to £47,979. The estimate of the consulting engineer was £48,500.

ALREADY more than 60 per cent. of the space available for the Birmingham section of the British Industries Fair, to be held in 1930, has been let and the necessary deposits paid.

ONE of the oldest post windmills in the country, that at Brill, which bears the date 1668, has been purchased by the lord of the manor, Major H. L. Aubrey-Fletcher, for permanent preservation.

IT is claimed that a new record has been set up by a Junkers aeroplane which rose to a height, on May 26th, of 12,500 metres. The previous record was held by America with 11,710 metres.

A GEORGE Stephenson Memorial Tablet, which has been erected on the cottage at Wylam in which he was born, will be unveiled on Saturday, June 8th, at 2.30 p.m., by the Lord Mayor of Newcastle-upon-Tyne.

IT is proposed that a new vertical shaft should be sunk at the Geduld East gold mine, Transvaal, and that a reduction plant having a capacity of 60,000 tons per month should be constructed in connection therewith.

FROM the attendance statistics which have been published it would appear that the North-East Coast Exhibition should be a success. Estimates were based on a daily attendance of 20,000 people, and the average up to the present has been about 34,000.

WITHIN a year the grain storage capacity of Vancouver is to be doubled, and will then amount to 21,000,000 bushels. The latest addition which has been contracted for is a silo of 1,000,000 bushels capacity, with a large sacking shed, that is to cost about 1,000,000 dollars.

THE last of Chicago's old swing bridges over the Chicago River was put out of commission on April 30th by a hopper hydraulic dredge which knocked the Clark-street bridge from its turntable. The bridge will probably be demolished, as it is in process of being replaced by a new span of the bascule type.

THE recommendations of Mr. A. E. Val Davies, of Johannesburg, concerning the electricity supply at Salisbury, Rhodesia, include the scrapping the existing gas plant and its substitution by steam-driven sets at a cost of £53,000. He suggests that current should be distributed on the three-phase system by means of four wires.

THE President of the Board of Trade has appointed the following committee to inquire into the position as to the supply of scrap for steelmaking in the United Kingdom:—Mr. R. Roy Wilson (chairman), Sir Henry Fowler, LL.D., and Sir Alfred Herbert, with Mr. C. K. Hobson, Board of Trade, Great George-street, S.W. 1, as secretary.

AS last year, passengers on the "Flying Scotsman" non-stop expresses, both north and south-bound, will have an opportunity of picking up the B.B.C.'s running commentary on the Derby on June 5th. A receiver and loud speaker will be installed in one of the coaches, while all passengers out of earshot will be presented with stamped cards bearing the names of the winning horses.

WE hear that the Manchester Corporation Water Committee is to proceed with the first stage of the £10,000,000 scheme to add Haweswater to the city's sources of supply. The initial work, which will cost £5,000,000, includes a huge dam across the Mardale Valley. A new village, with church, school and cinema, is to be erected to house the workers. The scheme will take four years to complete.

IT has been decided that the Hanyang Arsenal, which is just upstream from the Hanyang Ironworks, at the confluence of the rivers Yangtze and Han, in China, should be reorganised for commercial purposes. The arsenal was originally largely equipped with British machinery, but it must now be out of date, or even little more than scrap. Nevertheless, there are many machines in this immediate district which might be put to a useful purpose with proper attention.

SPEAKING recently at the annual general meeting of the Iron Trades Employers' Insurance Association, Ltd., the Chairman (Sir Frederick Henderson, K.B.E.) said:—"The continued oversight of our works and yards by Inspectors under recent factory legislation is not unwelcome, but at the same time we are convinced by the experience of the Safety Committees sitting in so many of the establishments coming under our purview that the large majority of the casualties reported are due primarily not to the proximity of machines, nor to the absence of mechanical safeguards, but simply to the human element taking unnecessary risks, for which many Factory Regulations, involving frequently large expense, made little or no contribution to any reduction in the number of accidents."

THE productive and economic development of Sicily which, as regards natural resources ranks with the most flourishing regions of Italy, has hitherto been retarded by inability to make sufficient use of the electric power derivable from its hydraulic resources. The Italian Government, on the recommendation of the Ministers of Finance and of Public Works, has taken steps to remedy this defect by the grant of a concession for drawing water for hydro-electric development from the Southern Imera River. The scheme, which has received official approval, and has been prepared by Chevalier Giuseppe Puleo, engineer of public works of the Province of Palermo, comprises the construction of the largest artificial lake in Italy and the erection of a hydro-electric power plant capable of the production of about 200,000,000 kilowatt-hours per annum. This enterprise, which will be undertaken by the European Hydro-Electric Company of London, is regarded as of the highest importance, as it will operate the largest hydro-electric power plant in Sicily, and will therefore become a dominating factor in the industrial, mining and agricultural development of the country.

ELECTRIC MOTOR-CONTROL GEAR FACTORY

THE BRITISH THOMSON-HOUSTON COMPANY, LTD., RUGBY

(*For description see page* 607)

FIG. 1—CONTROLLER ASSEMBLING DEPARTMENT

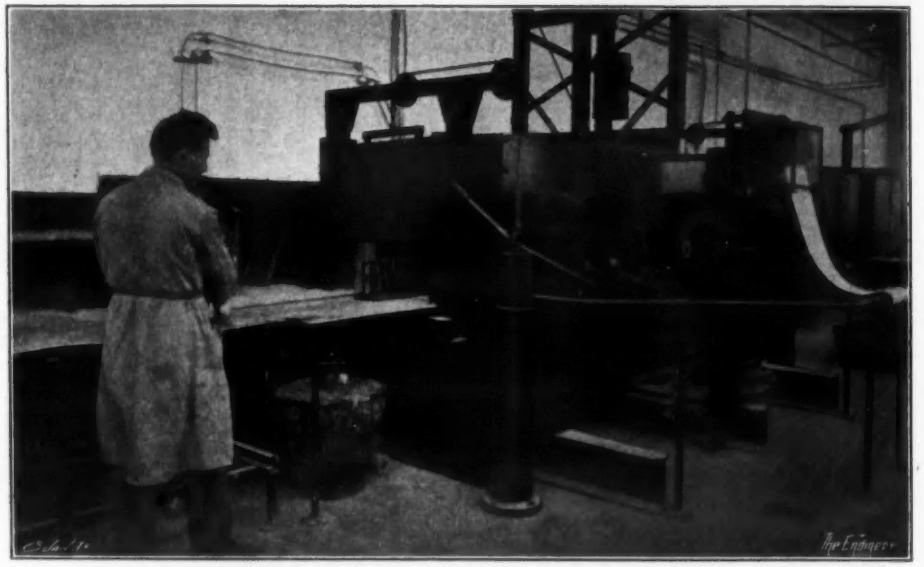


FIG. 2—ELECTRICALLY-HEATED OVEN

FIG. 3—UNBREAKABLE RESISTANCES DEPARTMENT

FIG. 4—FINISHING UNBREAKABLE RESISTANCE UNITS

The Engineer
Annual Subscription Rates

(Including postal charges).

Subscriptions will be accepted by the Publisher direct or through a newsagent at the rates and in the currencies stated below :—

BRITISH ISLES	£3	5	0	
CANADA	£3	3	0	Thick Paper edition.
	£2	18	6	Thin Paper edition.
ABROAD	£3	7	6	Thick Paper edition.
(except Canada)	£3	3	0	Thin Paper edition.

AFRICA	Central News Agency. All Branches
* £3 7s. 6d.	CAPE TOWN : Wm. Dawson and Sons, Ltd.,
† £3 3s. 0d.	29-31, Long-street (Box 489)
	JOHANNESBURG : C. Juta and Co.
ARGENTINE ..	BUENOS AIRES : Mitchell's Book Store, 576,
* £3 7s. 6d.	Cangallo
† £3 3s. 0d.	
AUSTRALIA ..	Gordon and Gotch (Australasia), Ltd. All
* £3 7s. 6d.	Branches
† £3 3s. 0d.	MELBOURNE : Robertson and Mullens,
	Elizabeth-street
BELGIUM ..	BRUXELLES : W. H. Smith and Son, 78–80,
* Fr. 590	Rue du Marché-aux-Herbes
† Fr. 550	
CANADA	American News Company, Ltd. All Branches
* $15·25	MONTREAL : Gordon and Gotch, Ltd., 334,
† $14·25	Notre Dame-street, W.
	TORONTO : Wm. Dawson and Sons, Ltd., 87,
	Queen-street East
	TORONTO : Gordon and Gotch, Ltd., 81,
	Queen-street West
CEYLON	COLOMBO : Wijayartna and Co.
* Rs. 44·5	
† Rs. 41·5	
CHINA	HONG KONG : Kelly and Walsh, Ltd.
* $37	SHANGHAI : Kelly and Walsh, Ltd.
† $34·5	
EGYPT	CAIRO : Express Book and Stationery Store,
* £3 7s. 6d. (Pt. 330)	9, Chareh Maghrabi
† £3 3s. 0d. (Pt. 308)	
FINLAND ..	HELSINGFORS : Akademiska Bokhandeln,
* M. 650	Alexandersgatan, 7
† M. 605	
FRANCE	PARIS : Boyveau and Chevillet, Rue de la
* Fr. 418	Banque, 22
† Fr. 390	PARIS : Berger Leverault, 229, Bld. St.
	Germain
	PARIS : Brentano's, 37, Av. de l'Opera
	PARIS : Dunod, 92, Rue Bonsparte
GERMANY ..	BERLIN : H. Hermanns, Friedrichstrasse 218,
* R. mks. 70·00	S.W. 48
† R. mks. 65·00	WESTERN GERMANY : Fritz Rehfus, Blumen-
	thalstrasse 10, Cologne
	LEIPZIG : K. W. Hiersemann, Konigstrasse 29
HOLLAND ..	ROTTERDAM : Hector's Boekhandel, Noord-
* Fl. 41·0	blaak 59
† Fl. 38·00	ROTTERDAM : Techn. Boekhandel, "Plan C,"
	Gelderschestraat 4
INDIA	BOMBAY : Thacker and Co., Ltd.
* Rs. 45	CALCUTTA : Thacker, Spink and Co.
† Rs. 42	
ITALY	MILAN : Ulrico Hoepli
* Lire 300 ..	ROME : Maglioni and Strini, 307, Corso
† Lire 280	ROME : Fratelli Treves, Corso Umberto 1, 174
	ROME : Fratelli Bocca
	TURIN : Rosenberg and Sellier, v. Maria
	Vittoria 18, and their Branches at Naples
	and Rome
JAPAN	Maruzen Co., all Branches
* £3 7s. 6d.	
† £3 3s. 0d.	
JAMAICA	KINGSTON : Educational Supply Co.
* £3 7s. 6d.	
† £3 3s. 0d.	
NEW ZEALAND	AUCKLAND : Whitcombe and Tombs, Ltd.
* £3 7s. 6d.	Gordon and Gotch, Ltd. All Branches
† £3 3s. 0d.	NAPIER : J. Wilson Craig and Co.
RUSSIA	LENINGRAD : Mezhdunarodnaya Kniga, Pros-
* £3 7s. 6d.	pect Volodarsky, 53 A
† £3 3s. 0d.	MOSCOW : "Litisdat," Kousnetsky Most, 5–15
STRAITS SETTLEMENTS	—SINGAPORE : Kelly and Walsh,
* $29·25	Ltd.
† $27·25	
SWEDEN	STOCKHOLM : A/B Wennergrens Journal-
* Kr. 61·00	expedition, Stockholm 1
† Kr. 57·00	STOCKHOLM : A/B C. E. Fritzes Kungl.,
	Hofbokhandel, Fredsgatan, 2
SWITZERLAND	BERNE : Joh. William De Groot, Laupenstr. 5
* Fr. 85·20	ZURICH : Rosa Leibowicz, 4, Ankerstr.
† Fr. 79·50	
UNITED STATES	International News Co., 131, Varick-street,
OF AMERICA	New York, N.Y., and all Branches
* $16·40	Entered as second-class matter at the Post Office,
† $15·25	New York, N.Y., December 12th, 1896, under the
	Act of March 3rd, 1879 (Section 397, P.L. & R.)

* *Thick Paper.* † *Thin Paper.*

These rates are liable to alteration if exchange fluctuations require it.

*** READING CASES, *to hold two copies of* THE ENGINEER, *cloth sides and leather backs, can now be supplied at 4s. 9d. each, 5s. 3d. post free.*

"THE METALLURGIST."

This Supplement, which deals with the Science of Metallurgy, both ferrous and non-ferrous, is published free with the last issue of THE ENGINEER in each calendar month.

ADVERTISEMENTS.

The charge for Classified Advertisements is 1/- per line up to one inch —minimum charge 4/-; those occupying one inch or more at the rate of 12/- per inch. Orders must be accompanied by a remittance. The rates for Displayed Advertisements will be forwarded on application. Classified Advertisements cannot be inserted unless delivered before TWO o clock on Thursday afternoon (the day before publication).

Letters relating to the Advertisement and the Publishing Department of the Paper are to be addressed to the Publisher, all other letters are to be addressed to the Editor of THE ENGINEER.

THE ENGINEER DIRECTORY.

This Directory, which is published annually in the interests of advertisers in THE ENGINEER, may be obtained free of charge on application to the Publisher.

Postal Address, 33, Norfolk-street, Strand, W.C. 2.
Teleg. Address, "Engineer Newspaper, Estrand, London."
Telephone Nos. Central 2256, 2257.

By arrangement with Reuter's Engineering Service, **The Engineer** *contains the latest news from all parts of the world which is likely to be of interest to engineers.*

Contents

THE ENGINEER, May 31st, 1929. PAGE

A SEVEN-DAY JOURNAL 589
THE SHANNON POWER SCHEME. No. VI. (Illus.) 590
THE "ROCKET." (Illus.) 592
LETTER TO THE EDITOR—
132,000-Volt Cables 594
STEEL v. WOODEN SLEEPERS IN RHODESIA 594
NORTH-EAST COAST EXHIBITION. No. III. (Illus.) 596
RAILWAY AND ROAD MATTERS 599
NOTES AND MEMORANDA 599
MISCELLANEA 599
LEADING ARTICLES—
Spain 601
The Study of Markets 601
OBITUARY—
Herbert J. Marshall 602
THE HOLLAND-AMERICA LINER "STATENDAM." (Illus.) 602
BOOKS RECEIVED 603
300-KW SELF-CONTAINED GEARED TURBO-GENERATOR SET. (Illus.) 605
IRON AND STEEL INSTITUTE 607
SIXTY YEARS AGO 607
THE INSTITUTION OF GAS ENGINEERS 607
A VISIT TO THE B.T.H. ELECTRIC MOTOR-CONTROL GEAR FACTORY. (Illus.) 607
B.E.S.A. SPECIFICATIONS 609
PROVINCIAL LETTERS—
The Midlands and Staffordshire 609
Lancashire 609
Sheffield 610
North of England 610
Scotland 611
Wales and Adjoining Counties 611
PERSONAL AND BUSINESS ANNOUNCEMENTS 611
CONTRACTS 611
CATALOGUES 611
CURRENT PRICES FOR METALS AND FUELS 612
FRENCH ENGINEERING NOTES 613
BRITISH PATENT SPECIFICATIONS. (Illus.) 613
FORTHCOMING ENGAGEMENTS 614
PARAGRAPH—
Newcastle Advertising Convention 611

SIXTEEN-PAGE SUPPLEMENT—"THE METALLURGIST."

NOTICES TO READERS.

*** *If any Subscriber abroad should receive* THE ENGINEER *in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.*

*** *All letters intended for insertion in* THE ENGINEER *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** *No undertaking can be given to return drawings or manuscripts; correspondents are therefore requested to keep copies.*

The Metallurgist.

THE MAY NUMBER OF THE MONTHLY METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.

THE ENGINEER.

MAY 31, 1929.

Spain.

IT has been estimated that we purchase from Spain twice as much as she buys from us. Even if invisible imports do something to rectify the balance that is not a very satisfactory state of trade, and a good deal of anxiety with regard to it has been exhibited of late by British manufacturers, particularly by those engaged in engineering. It is well known that industrial Spain is awakening to a new life, and that she is determined to exploit her own resources for her own advantage. A high tariff wall has been erected to keep out foreign importations of anything that can be manufactured internally, and encouragement is being offered to capitalists to develop national industries. The exhibitions at Barcelona and Seville may be regarded as indications of this new spirit which is moving in Spain. Nominally international, the Barcelona Exhibition is, indeed, rather directed towards the augmentation of Spain's own industrial life than to the development of trade with other nations. The Seville (Ibero-American) Exhibition is on a different plane and is of less interest to the engineering industries of this country. Just as in Italy, the war seems to have caused the shaking off of lethargy and the beginning of a new industrial life, so in Spain a new spirit is moving. The country is working hard and appears to be determined to make the most of its fine natural resources and to take its place amongst the other great industrial nations of Europe.

A recent visit of inquiry revealed certain facts which are of particular interest to manufacturing engineers. A disturbing symptom is the continued fall in the value of the peseta. It is difficult to explain, but seems to be in some measure due to a national uneasiness, though careful inquiry did not lead to the conclusion that a serious political upheaval is imminent. The people appear to be contented and quiet; work is plentiful—there are practically no unemployed—wages are high, and the wants of the Spanish workmen are few. Such discontent as exists prevails amongst the professional and bureaucratic classes, and is not shared by the proletariat. There is not enough here to upset the value of the peseta, and there are ample gold reserves to afford adequate cover for the note issue. It seems then that we must look for other reasons than internal discontent. They are possibly to be found in the very heavy commitments upon roads and public works and, a temporary reason, on the prospect of a rather poor harvest. We mention this matter because it is impossible to dissociate the value of money from problems of international trade, but a question of deeper interest to manufacturing engineers is that of tariffs. It is hopeless, we are convinced, to look for any reductions of those that exist. Spain is wedded to protection, and a recent committee has even reported in favour of considerable increases. It is not likely, however, that the Government will acquiesce, and although tariffs will probably remain at their present high level, there is little reason to fear further burdens in that direction. The Government ostensibly gives every preference in all contracts to home manufactured goods and machinery, but an alliance with a reputable Spanish organisation which provides for a certain portion to be of Spanish manufacture, whilst essential and particular portions are imported, is able to satisfy the authorities, who show a disposition to regard the matter with reason. Several British engineering firms have already established works in Spain, operated by Spanish companies, whilst others have associated themselves with existing Spanish concerns. By such an arrangement it is possible to surmount the prohibitive wall, for the Spanish authorities are wise enough to see that their own industries may be encouraged and their prospects of success, in many cases, be improved by permitting the importation of parts which can be more economically imported than made locally. Such amalgamation of interests is profitable both to Spain and Great Britain, and we may hope to see the expansion of it.

The industrial future of Spain would appear to be very promising. Her needs are yearly increasing. No longer is she a country secluded from the rest of Europe and living her own picturesque life in her own picturesque way. Her demands for manfactured goods must continue to grow, and it is difficult to see how it is possible to provide from her agricultural population factory labour which can produce efficiently to meet the growing demands. It takes several generations to produce efficient productive labour, and there are no signs that Spain can make herself independent of the outside world for generations to come, if ever. And no tariff walls can, under these conditions, stop imports of the more highly finished and better-class goods such as Spain is yearly demanding in greater quantities. British goods and British business methods are still popular, but Spanish business requires a flexibility and knowledge which is, unfortunately, too often lacking. The uncertainty of the exchange must act as a deterrent to trade, as also the burden of the heavy duties, but as a country Spain is prospering and offering continually a larger field for foreign trade, especially in the more highly finished products.

The Study of Markets.

THOUGH much has been written recently on the subject of selling goods abroad, the question is one which can never lose its interest to a nation like ours, which lives so largely by export trade. Most writers, however, have laboured the details of salesmanship to such an extent as to distract attention from something which is much more fundamental, namely, the capacity of any particular foreign market to absorb a given product. Supposing that a firm equips itself for export trade by having competent representatives abroad who speak the language of the country fluently; by having competent men at home who can write it; by quoting in the weights, measures, and currency used by the customer; by giving prices of goods, inclusive of duty and freight, delivered to the customers' town; by willingness to supply what the customer wants and asks for, instead of trying to sell him what it is thought he ought to want; and, in short, by doing everything that common sense dictates should be done if foreign trade is to be rendered easy rather than difficult or impossible, even then business will not be obtained if it is not there to be got. This statement may seem too obvious to need making, and dangerous, moreover, in that it may tend to discourage effort.

But it has implications which are not so obvious, and it is helpful rather than dangerous if it serves to direct enterprise where it will be best rewarded. There are fields which are worthy of intense cultivation and others that are not. A perfected sales organisation is a costly department, the expense of which can only be justified if its efforts are mainly employed where there is a prospect of a satisfactory harvest.

The selling of a given quantity of goods per annum in any market necessitates a corresponding capacity of absorption by the population which forms the market. This capacity will naturally depend on the nature of the goods, on their price, on the number and wealth of potential buyers, and on the supply of rival goods. These are matters which are quite outside the control of any selling organisation. The latter may perhaps bring pressure on the works to modify the first or the second to meet the exigencies of the market. It may also secure trade at the expense of rivals by more efficient support from the home firm, or by better business methods, but what it cannot hope to do is to make the population of any country consume more than a fairly definite number of articles of a given kind per annum. The estimation of this number should be the first care of any firm determined to take export business seriously. If it is placed too high, false hopes are raised and much money may be wasted in trying to dispose of goods which the market simply has not the capacity to absorb. If, on the other hand, it is under-estimated, the market will be under-exploited and the sales that are made will give rise to a satisfaction which certainly would not be felt were it known how much greater they might have been. Not long ago a certain firm was congratulating itself because it sold a few machines in Canada every year. Had it realised the immensity of the market and that for every machine sold a dozen or a score could have been disposed of by the help of a slightly more effective representation, it could have developed a much more extensive business. In general, caution, conservatism, and, we fear we must add, ignorance tend towards under-estimation of the possibilities of a market. The cases of over-sanguineness are few, and here again ignorance is almost always to blame. No one can be wise enough to predict how many machines he could certainly sell during the next year in any particular part of the world, but it is not too much to expect the responsible heads of firms to know fairly accurately what the number might be. There is no difficulty in finding out how many power stations, waterworks, tramway systems, and other public utilities exist in any civilised country where they are situated and what are the sizes and characteristics of each. A very little research among technical literature will give the details of the equipment of all the important ones. It is almost as easy to find out the number and location of the principal industrial plants, sugar factories, collieries, paper mills, textile factories, and so on. From statistics of this kind, covering the classes of potential customers for any particular machines or goods, one can form, at any rate, some idea of what possibilities a market affords. Yet how often, we wonder, is such a statistical survey made and kept up to date. It must, indeed, be kept more than up to date, for the potential customers most interesting to the manufacture are often those who are contemplating new works altogether. It is no secret that once a project has arrived at the stage of tenders being called for the customer has often decided, subconsciously if not more definitely, to whom the contract will be awarded. This is especially the case in the newer countries, where the reputation of particular manufacturers, and especially any preliminary assistance they may have given in getting out the scheme, count for very much indeed. How many good contracts could have been obtained, and deservedly obtained, by home firms had they only known of them in time. This foreknowledge of inquiries and guidance of customers are only possible with capable representatives on the spot, and there is a limit to what any firm can afford in the way of representation. The object, therefore, must be to apply selling effort only in proportion to the potentialities of the locality, and this brings us back to the importance of the home firm knowing as exactly as possible what those potentialities are. Belgium, for example, is a neighbouring and neighbourly country, the capital of which can be reached in about eight hours from London. It imports nearly the whole of the steam turbines used. Here, one would think, was a most valuable market for the British steam turbine maker; yet, unless we are mistaken, there are only some two or three British-made steam turbines in all the public power stations of the country. It is legitimate to wonder whether things might not have been different if British makers really studied the Belgian market, knew how many machines were imported by Belgium of recent years, and how many more were likely to be imported in connection with the great electrification scheme now decided on; if they knew the prices obtained, the guarantees given, and the nature of the banking or financial organisations behind the power companies. Their foreign rivals study such matters, the principal continental turbine builders having each an office in Brussels to keep in touch with them.

We do not, however, wish to stress this particular case, for the question is one which covers the whole manufacturing industry and is as wide as the world. Every aggregation of human beings, white, black, or yellow, can consume some quantity, from zero up to a fairly definite maximum, of any particular goods per annum. It is the essence of a satisfactory export business to determine this maximum and then to proportion the selling effort to the prospective trade. If export trade is worth attempting at all it should be attempted properly, and that is, in the light of all possible knowledge relative to the market. A representative on the spot is invaluable for details, but it must be remembered that sometimes it is easier to get information in London through official or trade channels than it is for a correspondent in some out-of-the-way part of the world to collect it. However it is obtained, it can only be properly interpreted by someone who is personally acquainted with the country and who knows something of the local, industrial, climatological, financial, or political conditions. There may be a demand for steam traction engines in a district, for example, where no engine with a fire-box proportioned for good English coal could give satisfaction. Or a certain city may want a number of road sweeping machines, but will not be content to receive those of the ordinary British pattern, which in a country where the rule of the road is to the right must necessarily sweep all the rubbish into the middle of the street. Everyone who has lived much abroad, and especially in the newer countries, is familiar with mistakes made by manufacturers, and sees how much the prestige of the latter is lowered thereby. They say that their customer ought to have told them of the non-British conditions, and he retorts that they ought to have known, and from the point of view of business he is in the right. *Caveat emptor* may be a good legal maxim, but it is a bad commercial one, for it is buyers who place orders and who make or mar the reputation of a firm. The capacity of a market to absorb machines of a certain type may have been correctly estimated, but unless the details of design are suitable for that market, the machines will be nearly as unsaleable as if no market existed. It is a really scientific study of the possibilities of the markets of the world for which we plead, for without this the efforts of a good selling organisation may be largely wasted in unsurveyed fields.

Obituary.

HERBERT J. MARSHALL.

WE regret to have to put on record the death of Mr. Herbert J. Marshall, joint managing director with Major H. D. Marshall, of Marshall, Sons and Co., Ltd., of Gainsborough, which took place suddenly at his home, Ordsall Hall, on Wednesday, May 22nd.

Mr. H. J. Marshall, who was born in February, 1866, and was therefore in his sixty-fourth year at the time of his death, was the son of the late Mr. James Marshall, the founder of the well-known Gainsborough firm of engineers. He was educated at Elstree and University College, London, and subsequently studied abroad—at Hanover and in France—before returning to Gainsborough to enter his father's works.

It is always difficult when writing of the life history of a man who has spent the whole of his professional career in a leading position with one firm—as did Mr. Marshall—to differentiate between the acts of the man and those of the firm. It is more than ever difficult when, as in the present instance, the man bears the same name as the firm—which was, to start with, a family concern—and was closely concerned with all its activities. We shall not, therefore, attempt to discuss Mr. Marshall's doings as apart from those of his firm. He began his connection with the business as quite a young man. He witnessed and took his part in its growth until, from comparatively small beginnings, its buildings came to cover an area of over 30 acres, and as many as 5000 workpeople were employed. To the manufacture of, principally, agricultural machinery and small steam engines was added that of tea preparing machines, grinding mills, gold dredging plant, and high-powered vertical and horizontal engines. He witnessed the growth of output until the number of portables turned out rose to as many as 160 a month, in addition to the production of much heavy agricultural machinery of other types. Then, later, the manufacture of light and heavy road rollers—steam and oil propelled—as well as of machinery specially adapted to road construction, including stone crushers and graders, concrete and asphalte mixing machines, &c., was undertaken. In all these developments Mr. Herbert Marshall took his part. In it all he was aided by having inherited, in no small measure, the technical skill of his father, but in no less degree, perhaps, by the fact that he had absorbed much of the commercial ability and business acumen of his uncle.

As a man, Mr. Marshall is described as being firm in his convictions, and even dogmatic. Not infrequently he was misunderstood even by those with whom he came most frequently into contact. However, doubtful as he might be of its success, he would generally give any suggestion or proposal made to him a good trial. Of him, it is said, too, that he was not merely an engineer of great skill, but that his powers of organisation and his general business

HERBERT J. MARSHALL

ability were outstanding traits of a character which were in many respects remarkable. He was a man who never spared himself.

Mr. Marshall, who became managing director of his firm in 1922, was a member of the Institution of Mechanical Engineers. He was a past president and member of Council of the Agricultural Engineers' Association, and was on the Executive Council of the National Union of Manufacturers. Until his health failed, a year or two ago, he was also a member of the Grand Council of the Federation of British Industries.

The New Holland-America Liner Statendam.

No. I.

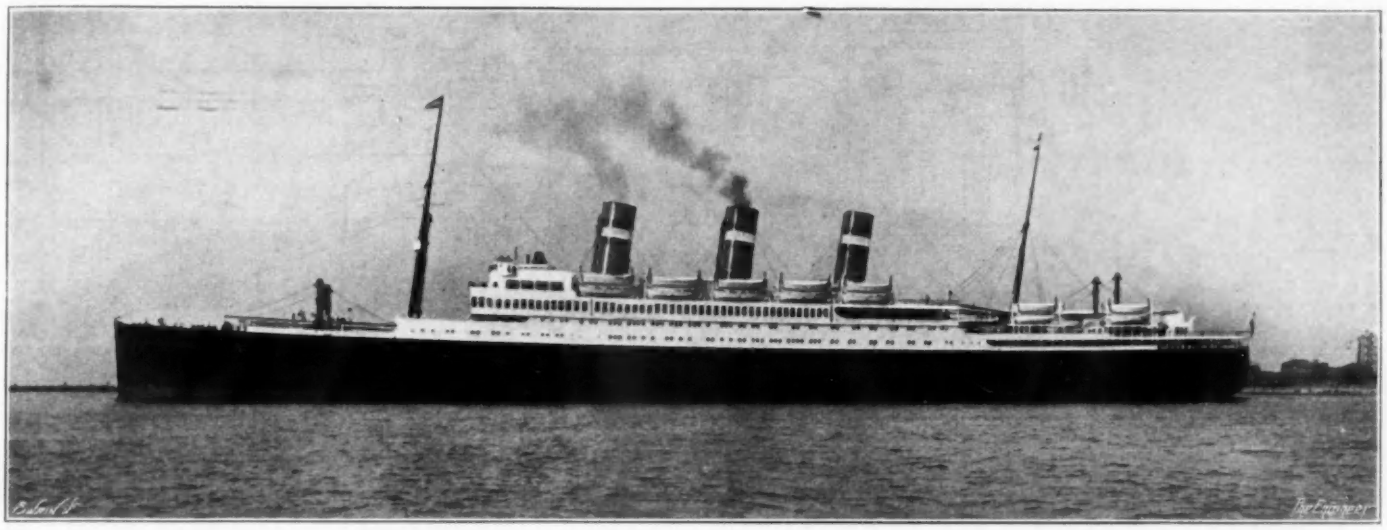
ON the morning of Saturday, May 4th, by the invitation of the directors of the Holland-America Line, we joined the company's new twin-screw passenger liner "Statendam" at Plymouth on her return maiden voyage from New York, making the short trip to Boulogne and Rotterdam. The accompanying engraving shows a broadside view of the new liner, which ranks high among the fast luxury passenger ships in the North Atlantic service.

The new ship is the third of the company's steamers to bear the name "Statendam." The first liner was a comparatively small vessel of some 10,000 gross tons, which was on the company's service for many years. Shortly before the outbreak of war in 1914 a new and much larger "Statendam" was approaching completion at Harland and Wolff's Belfast yard. The war intervened and she was later pressed into the Allies troop-carrying service under the name of the "Justicia." Shortly before the Armistice she was torpedoed and sunk some 600 miles off the coast of Ireland.

After the war plans were formulated for the building of a new "Statendam." The order was again placed with Harland and Wolff, Ltd., and in September, 1924, the hull of the present ship was launched at Belfast, but the question of the completion of the liner and the choice of her propelling machinery remained in abeyance for nearly two and a-half years. In the early part of 1927 it was announced that a special company had been formed in Holland to equip the liner with the latest type of high-pressure geared turbine machinery. In April of the same year the hull was towed from Belfast to Rotterdam and the ship was completed and her machinery installed by Wilton's Slipway and Engineering Company at that firm's

THE HOLLAND AMERICA LINER "STATENDAM"

HARLAND AND WOLFF, LTD., BELFAST, BUILDERS.



new Schiedam yard. The propelling machinery was designed and built by Harland and Wolff, Ltd., who throughout the work of completion co-operated closely with the owners and Messrs. Wiltons, through their resident engineer, Mr. W. Imrie.

Apart from the many novel features in the design and the decoration of the passenger accommodation, the "Statendam" is of great interest to marine engineers, representing, as she does, the most recent advance in geared turbine practice and the utilisation of high steam pressures and temperatures. We are able to state that the fuel consumption measured over a long period on the occasion of her first return voyage from New York to Plymouth worked out at the low figure of 0·61 lb. of oil per S.H.P.-hour for all purposes. The fuel consumption of the oil engine-driven generators has been included in this figure, but the energy output of these machines has not, we are informed, been added to the developed horse-power of the main machinery, which averaged 22,350 shaft horse-power.

Hull Design and Safety Equipment.

The principal hull dimensions and machinery particulars are summarised in the following table.

Hull Particulars.

Length overall	698ft.
Length between perpendiculars	670ft.
Breadth moulded	81ft.
Depth moulded to F deck	19ft. 6in.
Depth moulded to E deck	27ft. 6in.
Depth moulded to D deck	35ft. 6in.
Depth moulded to C deck	44ft.
Depth moulded to B deck	54ft.
Depth moulded to A deck	62ft. 6in.
Loaded draught	About 33ft. 6in.
Loaded deadweight	About 17,300 tons
Gross tonnage	30,000
Service Speed	19 knots

Passenger Accommodation.

First-class passengers	510
Second-class passengers	344
Tourist third cabin passengers	374
Third-class passengers	426
Officers and crew	600

Propelling Machinery.

Type: Twin-screw single-reduction Parsons type geared turbines	
Designed service output	22,000 S.H.P.
Propeller speed	125 r.p.m.

Boiler Installation.

Number of water-tube boilers	Six
Designed working pressure	400 lb. per sq. in.
Safety valve load	430 lb. per sq. in.
Boiler tube heating surface (each boiler)	7160 sq. ft.
Superheater tube heating surface	1680 sq. ft.
Air heater tube heating surface	7160 sq. ft.
Total superheated steam temperature	650 deg. Fah.
One auxiliary heating boiler—	
Heating surface	600 sq. ft.
Working pressure	100 lb. per sq. in.

Auxiliary Generator Sets.

Number of auxiliary oil-electric generator sets	Four
Designed output each set	400 kW
Number of cylinders each set	Six
Cylinder bore	330 mm.
Stroke	680 mm.
Designed running speed	290 r.p.m.

An unusual feature in the deck arrangement is the extension of the top deck beyond the line of the lower decks for about 1ft. 6in. on either side, so as to give a total width of 84ft., which affords additional promenade deck width without reducing the size of the public rooms. The water-tight subdivision of the hull has been carefully considered and there are eleven water-tight bulkheads with eighteen doors operated either locally or from the bridge on the Harland electrical system. The cellular double bottom is carried practically the whole length of the hull, and it is largely used for oil fuel and fresh water, of which an exceptionally large quantity is carried. Further deep tanks for oil fuel, which enable the ship to carry close upon 3000 tons of oil fuel, enough for a round trip, are provided. The main water-tight bulkheads are carried up to C deck level, and in the boiler rooms additional protection is provided by longitudinal wing bulkheads which extend up to the E deck level. The space between these bulkheads and the ship's side is suitably partitioned for fuel oil bunkers. Above the main water-tight bulkheads fireproof screens are arranged at frequent intervals and the ship is fitted throughout with the "Rich" smoke detection and fire extinguishing apparatus.

Among the navigation instruments and auxiliary devices we noted a Sperry gyro compass with an automatic steering attachment and a course recorder, while Kelvin magnetic compasses are also carried. An interesting piece of apparatus is a Langevin-Florisson depth indicator and analyser, which, by means of an echo sounding system and an interrupted spark recorder, shows the depth of water beneath the keel at any given moment. Other apparatus includes the latest type of wireless equipment and under-water signal gear.

Referring to the accompanying illustration, it will be seen that twenty-eight lifeboats, which include motor lifeboats, are carried in seven pairs arranged one above the other in Welin-McLachlan Swedish type davits on each side of the ship. We were given to understand that the capacity of the lifeboats is such that under certain conditions, when less than the full complement of passengers is carried, the lower lifeboats can be omitted, thereby giving increased space on the boat deck. On each of the boats we noted there was a removable skid of Dutch design, the object of which is to enable the boats to be lowered down the side of the ship even when under a heavy list. On the various decks there are large promenading spaces, and special areas are set apart for deck games, the principal space allotted for that purpose being the after part of the boat deck.

Passenger Accommodation.

Although the space available precludes us from giving any detailed description of the cabins and public rooms, a brief reference to their design and decoration may be made. The first-class accommodation includes a large number of single berth state rooms with a bathroom attached, while several suites of rooms are also available. The windows are of an improved type, which replaces with advantage the ordinary round side lights. In all private and public bathrooms there is a supply of fresh water laid on to the baths, a provision which, while requiring more fresh water storage capacity and additional fresh water pumps, is much appreciated by the passengers.

The extra width of the ship on the top deck is particularly noticeable in the large palm court decorated in Chinese style, which forms the forward part of the boat deck. This room is 84ft. wide and runs the full width of the ship. Its length is 48ft. and the general height of 11ft. is raised to 16ft. at the large central dome. By day a fine view of the sea is obtained from this room through large square windows, and the indirect lighting at night is very effective. The doors open on to the boat deck and a staircase leads down to the main entrance hall on the promenade deck level, forward of which is the library. From the hall there are lifts to all the lower decks in addition to which there are the usual stairways at the forward and after parts of the ship. A noteworthy room on this deck is the lounge, which is panelled in oak to the full height of 20ft. This room has a width of 74ft. a length of 52ft., and a centre dome. A feature of the decoration is a group of three finely executed Gobelin tapestries. Further aft is the smoke room, which is panelled in dark mahogany and is decorated in the old Dutch style. It is of interest to learn that the woodwork for both these rooms was originally planned and built for the second "Statendam," and it has been preserved in excellent condition since 1914. The ship's entrance hall is on B deck, two decks below the promenade deck, the A deck being mainly reserved for the suites of rooms and cabins already referred to. The centre part of C deck is occupied by the first-class dining saloon, which is over 120ft. in length and is the full width of the ship. In the centre of the room the roof is raised to a height of 18ft. 6in. An effective concealed lighting scheme has been adopted. There is a swimming pool on A deck, which affords a fine display of Delft tiling of appropriate design.

Aft of the first-class accommodation is the second-class dining room on C deck with the smoke room above. A lounge and second-class verandah *café* are also provided with elevator service. The tourist third-class accommodation at the after portion of the ship is roomy and well designed, with large deck spaces, while good third-class accommodation is provided in the forward part of the ship.

Deck Auxiliary Machinery.

The steering gear is of the Harland-Hastie hydraulic-electric type and all the cargo winches, capstans, windlasses and other lifting machinery are electrically operated. There are two combined windlasses and capstans forward and three capstans aft, with two 3-ton, twelve 4-ton, and two 6-ton winches. The ventilating system was designed by the Winsor Engineering Company, Ltd., of Pollokshaws, Glasgow, and consists of pleno-unit heating and ventilating plant. Most of the public rooms and cabins are supplied with air at 65 deg. to 70 deg. Fah., and individual requirements can be met by adjusting the air supply and using electric radiators when they are installed. The system comprises over forty heating and ventilating units with over 1200 high-pressure silent directional type louvres, twelve supply and twenty-four exhaust fans and 6½ miles of conduit. The total electrical horse-power for driving the fans and units is 335. The refrigerating plant was supplied by J. and E. Hall and Co., Ltd., of Dartford, and serves the insulated cargo spaces and ship's stores. It is electrically driven and is accommodated on a platform in the engine-room.

Main Propelling Machinery.

The main propelling machinery consists of two sets of Parsons design single-reduction geared turbines. Each set comprises a high-pressure and an intermediate-pressure turbine running at 1700 r.p.m., and a low-pressure turbine running at 1500 r.p.m., coupled to the propeller shaft by single reduction gearing. The propellers are of the three-bladed built-up type with a variable pitch, and they are designed to run at about 125 r.p.m., the service output of both turbines being over 22,000 S.H.P.

Steam is supplied by six high-pressure Babcock and Wilcox water-tube boilers. Each of these boilers is designed to supply steam at a working pressure of 400 lb. per square inch with a total superheated temperature of 650 deg. Fah. Only five boilers are required for the full output, and one boiler is therefore always available for a standby and for cleaning. In the boiler room immediately forward of the engine-room there are four boiler units, and the two other main boilers, along with the auxiliary Cochran type boiler, are accommodated right forward, an intermediate room being set apart for the four oil-electric 400-kW generator sets. The boilers are oil fired on the "White" system, and a detailed drawing of one of them will be found in THE ENGINEER for April 12th last.

All the auxiliary pumps with the exception of four Weir, direct-acting feed pumps, are electrically driven. Steam, however, for the feed pumps and for feed heating, galleys, and accommodation heating, as well as for the evaporators producing the make-up feed, is obtained by bleeding the main turbine at two points, the first between the high-pressure and intermediate-pressure turbine, and the second between the intermediate and the low-pressure turbines. When manœuvring, the steam supply is taken direct from the main boilers and is passed through specially designed de-superheaters supplied by Babcock and Wilcox, Ltd.

We shall refer to the general layout of the auxiliary plant and the feed connections in our second article, which will include a diagram of the feed circuits.

(To be continued.)

BOOKS RECEIVED.

Annales des Travaux Publics de Belgique, 1929, *Fasc. 2e, Avril.* Brussels: Goemaere, 21, Rue de la Limite.

Steam Turbines. By T. M. Naylor, M.Sc., &c. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 12s. 6d. net.

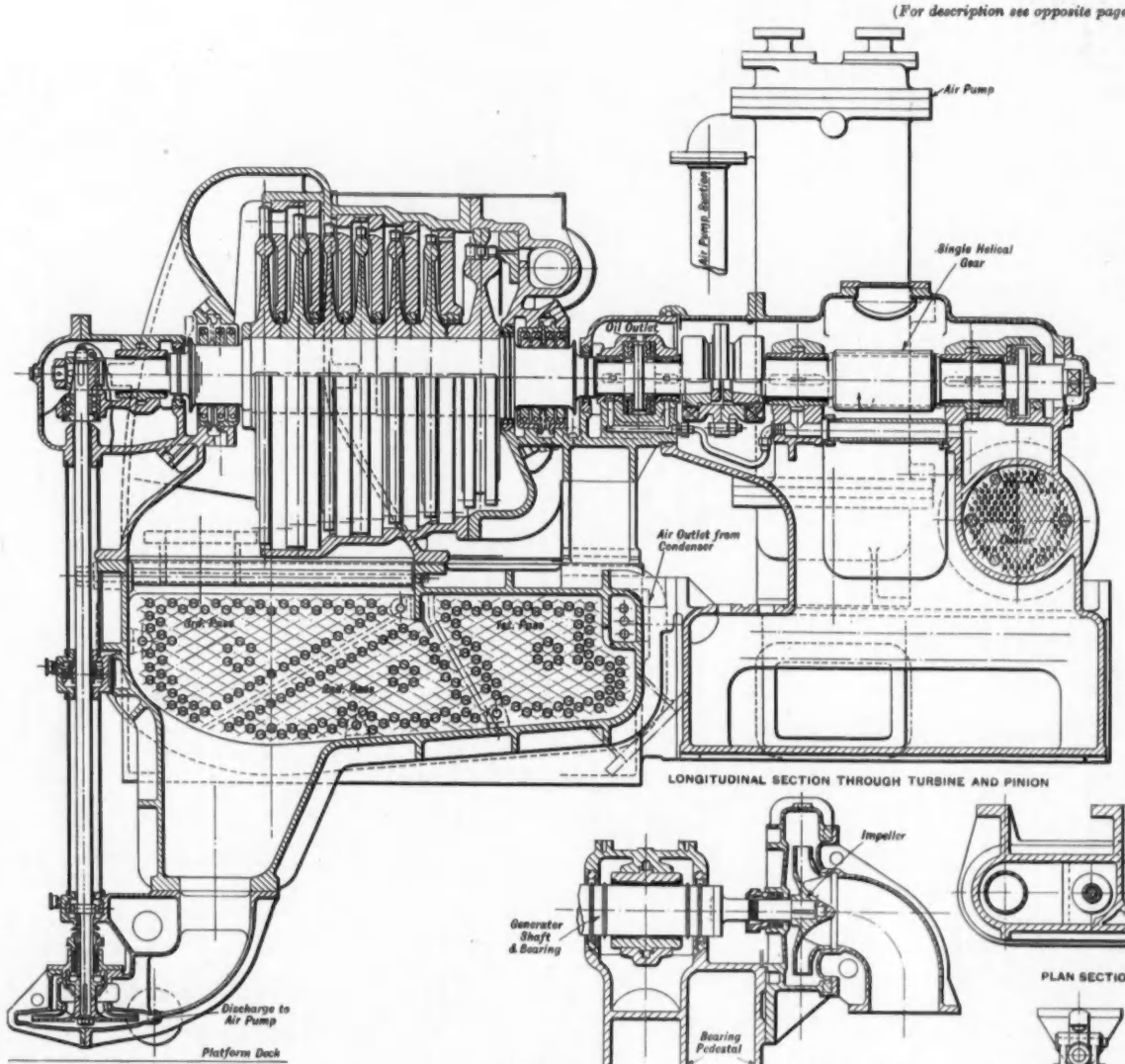
Portland Cement Association—Report of the Director of Research for the Year Ending November, 1928. Chicago: Published by the Association, 33, West Grand-avenue.

Wellington (New Zealand) Harbour Board, Statement of Accounts, with Annual Reports and other Statistics, for the Period Ended September 30th, 1928. Wellington: Published by the Harbour Board. 1929.

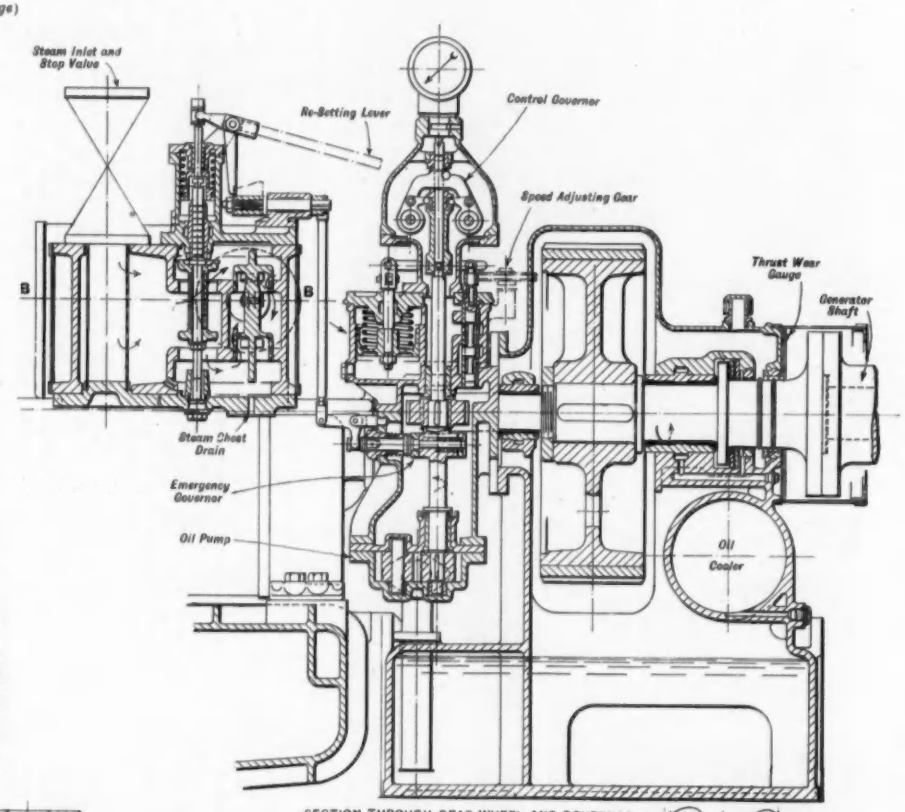
SECTIONS AND DETAILS OF 300-kW GEARED TURBINE AND CONDENSER

W. H. ALLEN, SONS AND CO., LTD., BEDFORD, ENGINEERS

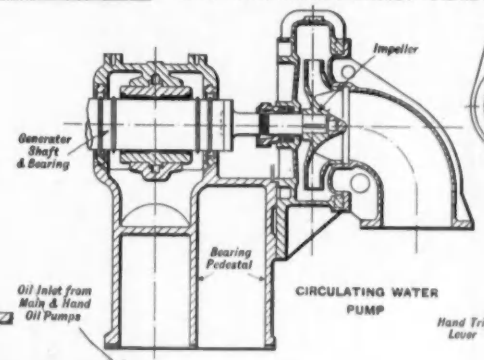
(For description see opposite page)



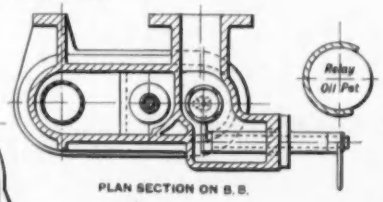
LONGITUDINAL SECTION THROUGH TURBINE AND PINION



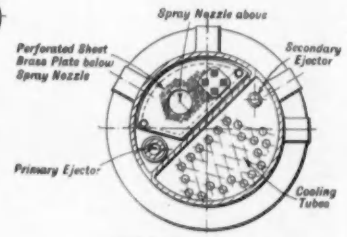
SECTION THROUGH GEAR WHEEL AND GOVERNOR



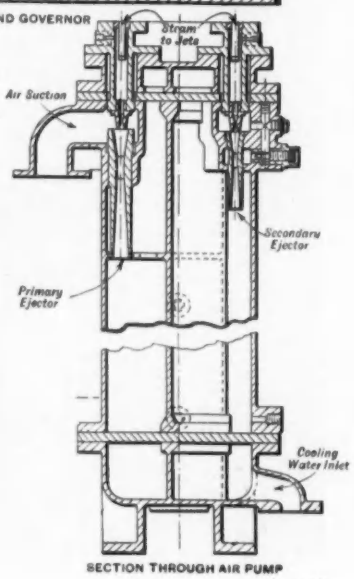
CIRCULATING WATER PUMP



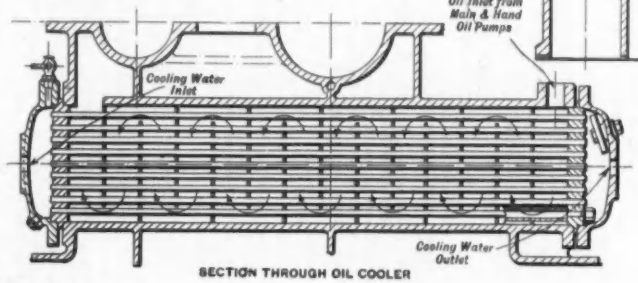
PLAN SECTION ON B.B.



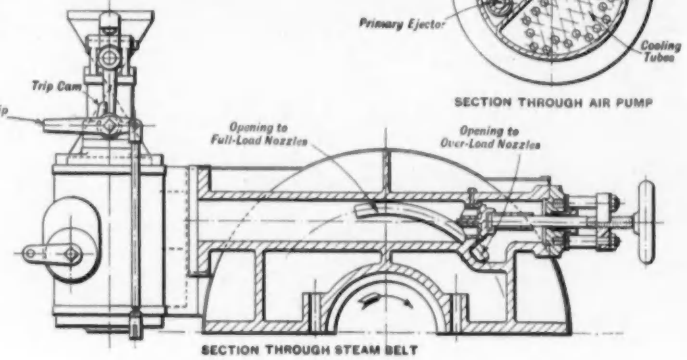
SECTION THROUGH AIR PUMP



SECTION THROUGH AIR PUMP



SECTION THROUGH OIL COOLER



SECTION THROUGH STEAM BELT

"THE ENGINEER"

SWAIN Sc

300-kW SELF-CONTAINED GEARED TURBO-GENERATOR SET

W. H. ALLEN, SONS AND CO., LTD., BEDFORD, ENGINEERS

A 300 kW. Self-contained Geared Turbo-generator Set.

In view of the limitations in the tonnage of modern warships, which were laid down at the Washington Conference, the question of the reduction of the weight of auxiliary machinery has become very important. In what follows we are able to give an illustrated description of a 300-kW geared direct-current turbo-generator set, complete with its sub-base condenser and all the necessary auxiliary pumps, which is one of several sets recently supplied by W. H. Allen, Sons and Co., Ltd., of Bedford, to the order of the British Admiralty. In the design of the plant very careful consideration was given to the reduction of weight and the space occupied. The firm is now in a position, it informs us, to supply generating sets of similar design with outputs up to and over 3000 kW, both for marine service and for land work. In the case of the power station, it will be clearly recognised that, in adopting such a design, the necessity for the usual condensing plant basement is dispensed with, so that the foundations required and the size of the turbine-house are smaller, and therefore less costly.

The Turbine and Reduction Gearing.

The half-tone engraving at the head of this page and Fig. 2, show the general arrangement of the set, and the drawings on page 604 give detailed sections through different parts of the turbine, gears, condenser and pumps. It will be seen that the three-flow condenser forms the base plate for the turbine, and that the oil cooler is accommodated in the gear casing. A two-stage steam ejector air pump, with its intercooler, are neatly grouped behind the gear case, while the governor and its controls occupy a prominent position at the front of the set, near to the high-pressure end of the turbine. The condensate extraction pump is of the vertical spindle type, and is driven through gearing from the rotor shaft at the low-pressure end of the turbine. The main circulating pump is bolted up to the pedestal of the outboard bearing, and is driven from an extension of the generator shaft. It will be seen that the circulating water is delivered to the condenser through a main, which is carried round the base of the set. These points in design are clearly shown in the half-tone engravings of the plant.

The turbine itself is of the "Allen" impulse type, with a single velocity-compounded stage followed by six velocity stages. It is designed to run at a speed of 6000 r.p.m., when supplied with steam at 170 lb. per square inch gauge pressure and 150 deg. Fah. superheat with a vacuum of 28in.

In order to facilitate examination and overhaul, the turbine casing is split on the horizontal centre line. Fig. 1 shows on the right the upper part of the turbine casing, with the steam chest, and to the left the lower part of the casing with the rotor in position.

The rotor is a steel forging and on it are fixed nickel-steel wheels, which are provided with balance holes. Stainless steel blades of low carbon content are fitted. The high-pressure nozzles are machined out from a solid steel forging, and the inter-stage diaphragms are made of special cast iron with the stainless iron guide vanes cast in position. From the section through the steam belt reproduced at the bottom of page 604, it will be seen that a separate hand-operated valve is fitted to control an additional group of high-pressure nozzles. These nozzles may be employed under overload conditions to give an increase in output over full load, of 10 per cent., or for full-load running when the steam pressure or exhaust conditions are not in accordance with those specified and mentioned above. From the section through the turbine given on page 604, it will be seen that a "Michell" type of double-thrust bearing is fitted at the coupling end of the turbine.

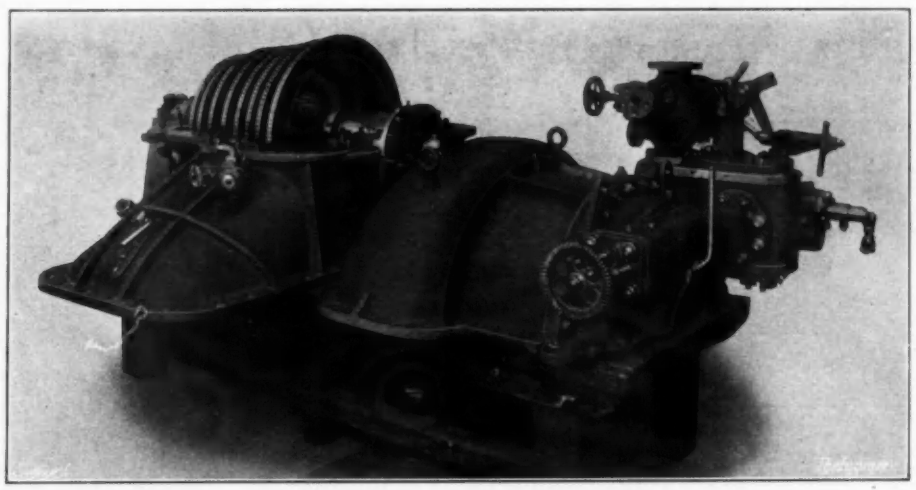


FIG. 1—UPPER AND LOWER TURBINE CASINGS

This bearing determines the position of the rotor and its duty is to absorb any incidental end thrust. Other thrust bearings of the same pattern are fitted on the pinion and gear shafts to deal with the thrusts from the gearing. It may be remarked that while the low-pressure end of the turbine is fixed rigidly to the condenser, the high-pressure end is left free to move axially in special guides in order to allow for expansion.

The reduction gears are of the single helical type, the pinion being connected to the turbine through a flexible coupling of the claw pattern, whilst the shaft in which the main gear wheel is mounted—see the section to the right of page 604—is coupled to the dynamo shaft by a rigid type of coupling. The gear wheel pinion is made from a nickel steel forging, whilst the wheel itself consists of a forged steel shroud shrunk and pinned to a cast steel spider, mounted on the gear wheel shaft. The lower part of the gear wheel casing containing the oil cooler is made in cast iron, but the upper part is of aluminium, in order to reduce weight. The same metal is employed for all the small covers and inspection doors.

Referring to the section through the main turbine, it will be seen that the carbon glands are provided both on the high and low-pressure ends of the turbine, which are steam sealed. At the high-pressure end of the casing, an additional labyrinth gland is also provided.

All the turbine bearings and the gearing and thrust bearings are lubricated and cooled by oil which is supplied under pressure by the forced lubrication pump. The gears are lubricated by spray in the usual manner. The lubricating oil pump is placed at the foot of the governor shaft, and is driven from it, and it is arranged to draw the oil from the bed-plate reservoir through a gauze strainer, and to deliver it past the oil relief and pressure regulating valves to the oil cooler, from which it is distributed to the bearings and gears. A supply of oil for the governor relay mechanism is taken from the pipe between the pump and the regulating valve, so that the pressure of this supply can be adjusted and so that the oil relay system is protected by the spring-loaded relief valve. For starting and stopping, there is a hand-operated oil pump.

Steam Distribution and Governor Gear.

From the sections reproduced on page 604, it will be

seen that the steam chest is of the three-compartment type, complete with the steam strainer, emergency valve and throttle valve. The emergency valve is of the double beat type, with, however, a single seat, and when it is set it is held open against the pressure of a strong spring by a catch which is clearly visible on the steam chest cover. A cylinder, which forms part of the cover, houses the spring and at the same time forms a dashpot. The throttle valve is of the double-ported piston or sleeve type, and it is sleeve oil is admitted under the relay piston, and its further supply is cut off by the floating lever as soon as the piston has moved far enough. The relay gear is designed to operate under a normal pressure of 30 lb. per square inch, and in the event of a failure in the pressure-oil supply, the relay piston spring automatically closes the throttle valve. To the left of Fig. 3 will be seen a hand wheel, which, through a threaded pinion spindle, controls the relative positions of the floating lever and the pilot valve, and so r.p.m., which is well below the first critical speed of 8200 r.p.m.

Condenser, Air and Water Pumps.

The condenser is of the three-flow surface type, with the exhaust steam flowing around the tubes and the cooling water through them. The total surface is 330 square feet, and the amount of cooling water required is 460 gallons per minute. A special cast iron shell is provided,

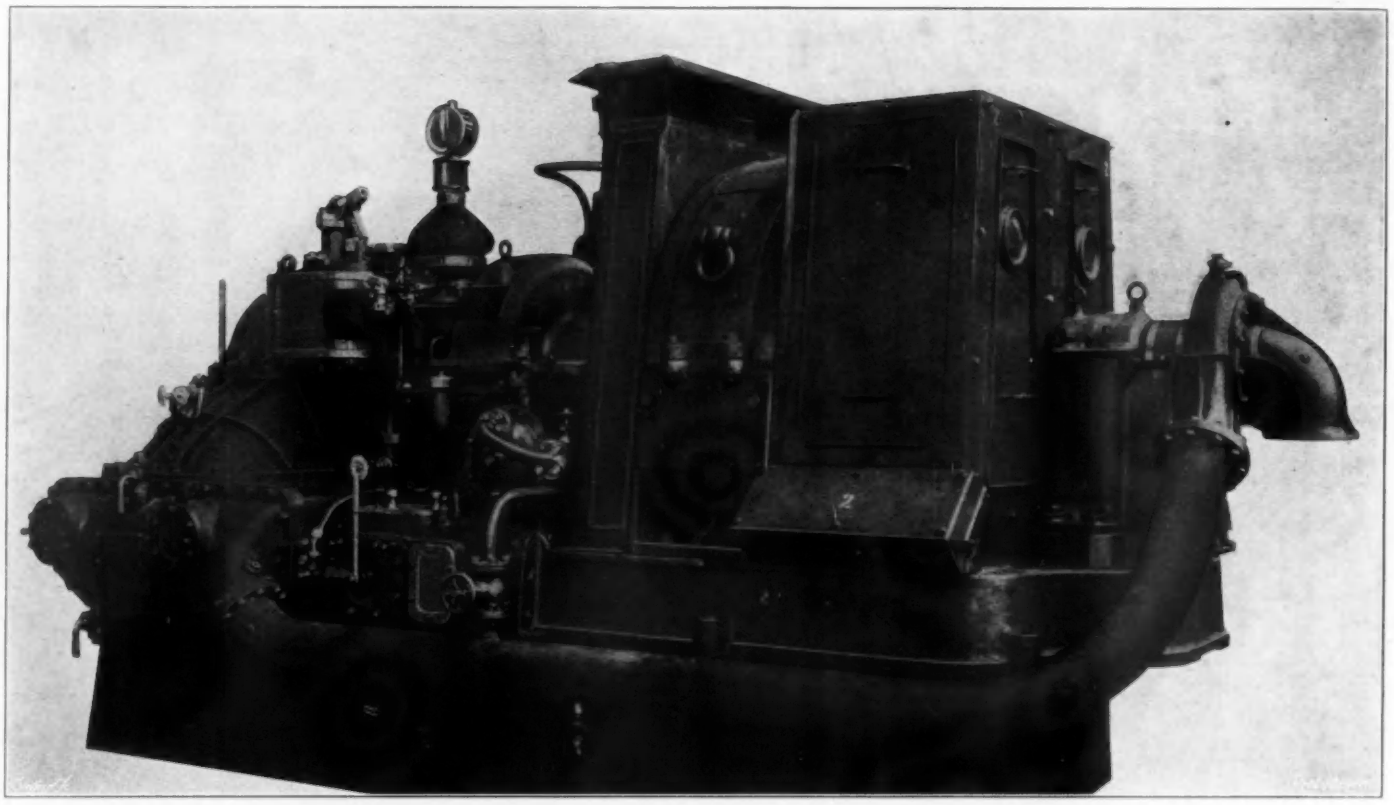


FIG. 2—GENERAL VIEW OF 300-kW TURBO-GENERATOR SET FROM DYNAMO END

operated by a rocking lever connected to the link gears of the relay cylinder of the governor mechanism.

The speed control governor is driven from the main gear wheel shaft—see page 604—through an auxiliary shaft which also drives the tachometer and the lubricating pump. The governor is of the centrifugal pattern and is designed to operate the steam control valve through an oil relay system. The system is shown diagrammatically in Fig. 3, and is very compact and sensitive, the oil pressure only operating the oil relay gear, which causes the control valve to follow proportionately every movement of the governor sleeve; the controlling power given by the relay is independent of and stronger than that exerted by the governor itself. To the right of Fig. 3 will be seen the relay piston A, which operates the throttle valve through link gear, the first part of which is the lever pivoted at C. On the left of the governor spindle is the pilot valve D, which is connected to the relay piston by the floating lever B, which is pivoted about the axis of the governor sleeve surrounding the spindle. Oil under pres-

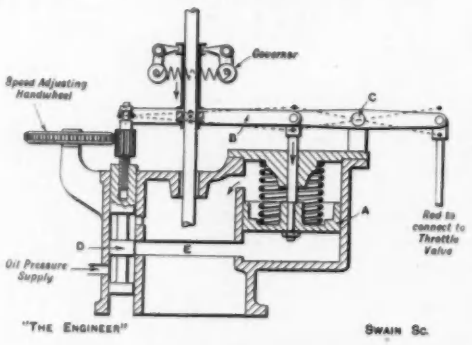


FIG. 3—DIAGRAM OF GOVERNOR GEAR

sure is admitted from the oil pump through the supply orifice in the wall of the pilot valve cylinder and passes to the relay cylinder. When the gear is in equilibrium the particular part of the valve indicated at D just covers the port leading to the oil passage E, connecting the pilot valve and relay cylinders. In the event of an increase in speed, the governor sleeve moves downwards and the floating lever B is swung about its relay piston end, which is stationary for a moment and so depresses the pilot valve. Oil is allowed to drain from the relay cylinder and the spring-loaded piston then moves down, closing the throttle valve through the link gear indicated on the extreme right. Meanwhile, the governor sleeve having become the fulcrum of the floating lever B, the falling relay piston raises the pilot valve. When the port leading to the relay cylinder is again covered by the valve, the relay piston reaches another new position of equilibrium, and remains in that place until a further movement of the governor takes place.

Conversely, for an upward movement of the governor enables adjustments of speed to be carried out under load conditions. The emergency governor, which is mounted below the main governor driving wheel, is of the unbalanced ring type. The ring is held concentrically with the shaft by a spring, until the turbine reaches a certain definite overspeed, when the centrifugal unbalance overcomes the spring pressure and the ring moves outwards, operating the

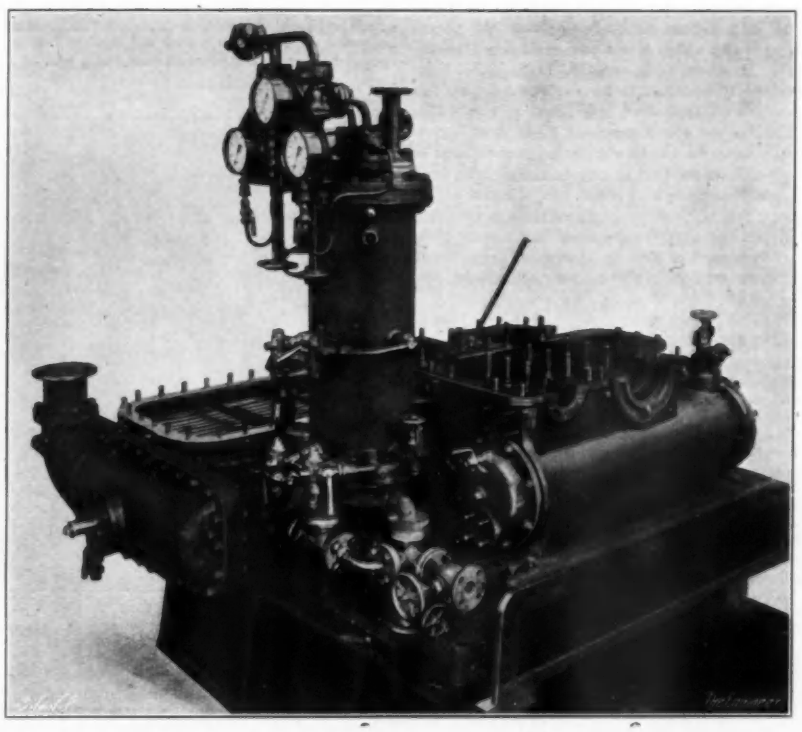


FIG. 4—CONDENSER AND GEAR CASE BASE, WITH AIR PUMPS AND OIL COOLER

trip gear. This gear releases the emergency valve, which is closed by its spring. In addition to these precautions, there is also an electric switch, which is connected to the emergency gear, and is operated by the same spring. In the case of the gear being tripped at overspeed, the switch isolates the generator electrically and so protects the set from the danger of motoring. The emergency governor is set to trip at a speed of from 6500 to 6700 with cast steel water ends, and Admiralty mixture tubes, with tube plates and supporting plates of naval brass. The tubes are secured in the plates by screwed ferrules and linen tape packings, and in the bottom of the condenser shell, there is a well, which is connected to the suction chamber of the condensate extraction pump. This pump is of the vertical-spindle type, and it is designed to run at 2500 r.p.m., having a capacity of 20 gallons per minute, when working against an external head of 40ft. Water sealing for the extraction pump gland is provided from the pump discharge, which is kept at a pressure of 20 lb. per square inch by a special throttling valve. The circulating pump is shown in section on page 604. It is of the single-suction centrifugal type, and has a gun-metal casing and impeller with a steel shaft fitted with bronze liners, which

is connected to the dynamo shaft by a rigid type coupling. It is supported on a bracket secured to the outboard bearing of the dynamo. The rated output is 480 gallons per minute, against 25ft. head, when running at 1000 revs. per min.

The air pump, a view of which, along with the condenser and gearing base plate, is reproduced in Fig. 4, is of the two-stage steam ejector type. The steam from the first stage ejector nozzles is condensed by a water spray nozzle below which there is a perforated base plate, the water being supplied from the extraction pump. The steam from the second stage ejector nozzles is condensed by a nest of cooling tubes, through which water from the extraction pump is continually passed. As will be seen from the drawing, the upper right-hand corner of page 604, the two steam ejectors, primary and secondary, are both contained in the circular casing. The condensed steam, together with spray water from the first stage, drains back to the condenser, and there is no loss of heat in the second stage as the heat from the second stage steam is absorbed by the condensate on its way from the extraction pump to the feed tank. Arrangements are made whereby a proportion of the condensate can be returned to the condenser through a valve-controlled by-pass connection. This assures that there is an adequate supply available for circulation through the air pump when starting up.

The 300-kW Generator.

The dynamo is of the "Allen" direct-current multipolar type, designed for a normal output of 300 kW at 225 volts, when running at the designed speed of 1000 r.p.m. Interpoles are provided and special consideration was given to the question of voltage regulation. As the general arrangement shows, there is only one outboard bearing provided, since the main gear wheel bearing adjacent to the generator coupling is specially designed to carry part of the weight of the armature. A rotatable field frame is fitted, which enables the bottom portion of the magnet to be raised for the purpose either of examination or of overhaul. In the example illustrated, the dynamo is arranged for pipe ventilation, and attention may be drawn to the light sheet metal covers fitted to the machine, and shown on page 606, which have been specially designed for quick and easy removal in the somewhat restricted space available.

Iron and Steel Institute.

As previously announced, the autumn meeting of the Iron and Steel Institute will be held at Newcastle-upon-Tyne, on Tuesday, Wednesday, Thursday and Friday, September 10th, 11th, 12th and 13th next. The following provisional programme has been arranged :—On Tuesday, September 10th, from 10 a.m. to 12 noon, a general meeting will be held in the Festival Hall at the North-East Coast Exhibition. Members who are taking part in the excursions will then be entertained to luncheon at the Grand Assembly Rooms, Barras Bridge, Newcastle-upon-Tyne, at the invitation of the Consett Iron Company, Ltd.; the Birtley Iron Company, Ltd.; Vickers-Armstrongs, Ltd.; and the English Steel Corporation; the Priestman Collieries, Ltd.; A. Reyrolle and Co., Ltd.; C. A. Parsons and Co., Ltd.; and the Wallsend Slipway and Engineering Company, Ltd. In the afternoon there will be alternative visits to :—(*a*) The new coke oven plant at Derwenthaugh, of the Consett Iron Company, Ltd., including the Birtley Iron Company's coal-cleaning plant installed there; (*b*) Blaydon Burn coke oven plant, &c., of the Priestman Collieries, Ltd.; (*c*) the Elswick Works of Vickers-Armstrongs, Ltd., and the English Steel Corporation; and to the works of (*d*) A. Reyrolle and Co., Ltd. Hebburn; (*e*) C. A. Parsons and Co., Ltd., Heaton; and (*f*) the Wallsend Slipway and Engineering Company, Ltd., Wallsend. In the evening, from 9 p.m. to 1 a.m., there will be a dance in the Grand Assembly Rooms, Barras Bridge, Newcastle, at the invitation of the local firms, including those on Tees-side, &c., who may agree to participate.

On the Wednesday the general meeting will be continued in the Festival Hall at the Exhibition, from 10 a.m. to noon. Members taking part in the excursions will then be entertained to luncheon at the Grand Assembly Rooms, at the invitation of the Consett Iron Company, Ltd.; Palmers Iron and Shipbuilding Company, Ltd.; and Swan, Hunter and Wigham-Richardson, Ltd. In the afternoon there will be alternative excursions to the followng works : —(*g*) R. and W. Hawthorn, Leslie and Co., Ltd., Hebburn; (*h*) the North-Eastern Marine Engineering Company, Ltd., Wallsend; (*i*) the new steel works and mills at Consett; (*j*) Palmers Shipbuilding and Iron Company, Ltd., Hebburn; and (*k*) Swan, Hunter and Wigham-Richardson, Ltd., Wallsend. In the evening at 8 o'clock there will be a reception by the Lord Mayor and Corporation of Newcastle-upon-Tyne, at the Grand Assembly Rooms, which will be followed by a dance.

On the Thursday, from 10 a.m. to 11 a.m., the general meeting will be continued in the Festival Hall at the Exhibition, and the party will proceed at 11.15 a.m. by road to Middlesbrough, &c. For the afternoon the following alternative visits have been arranged :—(*l*) South Durham Steel and Iron Company's works, West Hartlepool; (*m*) Dorman, Long and Company's works, Redcar; (*n*) Cargo Fleet Iron Company, Ltd., Middlesbrough; (*o*) Bolckow, Vaughan and Co., Ltd., Middlesbrough; (*p*) Darlington Forge, Ltd., Darlington; (*q*) Cleveland Bridge and Engineering Company, Ltd., Darlington; (*r*) Robt. Stephenson and Co., Ltd., Darlington; (*s*) Darlington Rolling Mills Company, Ltd., Rise Carr, Darlington; and (*t*) Ashington Coal Company's Collieries, Ashington; the visitors in each case being entertained at the works.

For Friday, September 13th, whole day excursions to :—(*u*) the river Tyne in a steam yacht provided by the River Tyne Commissioners; and (*v*) the Roman Wall and the Chesters Museum, &c., of which particulars will be issued later.

SIXTY YEARS AGO.

SIXTY years ago, in the Ashburnham Gardens at Cremorne, Chelsea, a captive balloon, "a magnificent aerial machine," on the construction of which Monsieur Giffard had expended over £10,000, was being exhibited for the entertainment of the public. The balloon was controlled by a rope 2160ft. long, which was anchored to a drum driven by a pair of engines. The "aerial monster," as we called it in a note in our issue of May 28th, 1869, had a diameter of 93ft. and weighed 600 lb. It had a capacity of 421,161 cubic feet and one inflation with pure hydrogen cost £600. The balloon was composed of three layers of linen separated by layers of rubber composition and was coated externally with five coats of boiled linseed oil and two coats of shellac varnish. The netting, guy ropes and other minor accessories, it was stated, weighed 4000 lb. and the anchoring rope 4350 lb. We had made an ascent in the balloon, but the weather was too boisterous to permit us to stay up for a prolonged period. Perhaps it was just as well, for a few days later the balloon, when no one was in the car, broke its rope and fled away with the wind. It came down some hours later at Aylesbury and was somewhat "out of repair" when finally secured. It seems scarcely surprising that the balloon broke away. A ton of hydrogen can lift itself and 13 tons in the air. A ton of hydrogen occupies about 392,000 cubic feet. Monsieur Giffard's balloon therefore had a total lift of about 14 tons. The envelope, the netting and other minor accessories and the anchoring rope had a total weight of 4 tons, so that there was left a disposable lift of some 10 tons. The number of passengers carried was not stated in our article, but at the most they could hardly have weighed more than, say, ½ ton. The anchoring rope when fully extended had therefore to take a load of 9½ tons or thereabouts. When the balloon was hauled down to the ground and when there were no passengers in the car—as at the time when it broke away—the load on the rope would be about 12 tons. The rope was 2¾in. in diameter at its point of attachment to the balloon and decreased down to 2in. in diameter at its point of attachment to the winding drum. It is difficult to suggest any reason why Monsieur Giffard provided such a large excess of disposable lift. By so doing he not only increased the cost of his ascents, but threw on the anchoring rope an unnecessary and, as it turned out, an unbearable load.

THE INSTITUTION OF GAS ENGINEERS.

THE annual general meeting of the Institution of Gas Engineers will be held on Tuesday, Wednesday and Thursday, June 4th to 6th next, at the Institution of Civil Engineers, Great George-street, Westminster.

The following order of proceedings has been arranged :—On the Tuesday morning the meeting will open at ten o'clock and after the transaction of the usual and other business the London Medal will be presented to Mr. H. C. Smith, of Tottenham, and the Institution Medal to Mr. Stephen Lacey, of London. The Diplomas awarded in 1929 under the Institution education scheme will also be presented. The President will then deliver an address. In the afternoon, at 3.15 p.m., there is to be a meeting of members and associate members for the purpose of approving the proposed by-laws for the new Chartered Institution, and at its conclusion a paper on "Construction of New Works—Oxford," by Mr. W. Eames Caton, of Oxford, will be presented. Subsequently the twenty-first report of the Joint Research Committee of the Institution and the University of Leeds will be discussed. In the evening, at 8 p.m., there will be a reception and dance, by invitation of the President, in the King's Hall, the Holborn Restaurant, Parker-street, High Holborn, London, W.C. 1.

On the Wednesday, at ten o'clock, the annual general meeting of the Benevolent Fund will be held, and at 10.30 a.m. the Institution meeting will be resumed. A paper on "The Incident of the Peak Load," by Mr. Frederic G. Gorman, of Sydenham, will be discussed, as will also the twenty-second report of the Joint Research Committee of the Institution and the University of Leeds : Studies in Carbonisation—Part IV., Influence of Various Factors on Ignition Temperature, Reactivities and Structure of Coke, and the twenty-third report of the Joint Research Committee of the Institution and the University of Leeds : Studies in Carbonisation—Part V., Temperature, Size of Coal, Blending with Inorganic Compounds. In the afternoon, at 3.15 p.m., the following are down for discussion :—(*a*) Gas Fellowship Report on "Factors Influencing the Reactivity of Coke," by F. J. Dent and J. W. Cobb, C.B.E (Livesey Professor); (*b*) Third Report of the Effluents Sub-Committee; (*c*) First Report of the Ammonia Sub-Committee; (*d*) Report of the Refractory Materials Joint Committee; and (*e*) Report of the Gas for Therapeutical Purposes Committee.

On the Thursday morning, at ten o'clock, a paper on "Notes on Purification," by Mr. George C. Pearson, of Birmingham, will be discussed, after which the Report of the International Illumination Committee will be considered. In the afternoon, at 2 p.m., members will leave the Thames Embankment, near Charing Cross Underground Station, by motor coaches for Sydenham, to visit the works of the South Suburban Gas Company.

On the Friday, June 7th, a visit will be paid to Hampton Court, leaving Westminster Pier—on the Thames Embankment, near Westminster Bridge—by steamer at 10 a.m.

THE announcement is made from New York of an agreement between the Soviet Government and the International General Electric Company, providing for an exchange of patents, as well as an exchange of designing, engineering and manufacturing information for a term of ten years beginning on July 1st next. American engineers will be sent to Russia to assist the Soviet Electrotechnical Trust in carrying out plans for the expansion of the electrical industry in that country. Soviet engineers will likewise go to the United States to study American methods in the manufacture of electrical machinery and equipment.

A Visit to the B.T.H. Electric Motor Control Gear Factory.

FOR many years past the British Thomson-Houston Company has specialised in the manufacture of industrial electric motor control gear, but although we have visited the company's Rugby works on many occasions, we have only recently made a close inspection of the portions of the factory that are devoted to the production of this equipment. While the large switchgear, such as that installed in central stations, is made at Willesden, all the small control gear is produced at Rugby in a building which forms part of the main works. Associated with this section is a drawing-office, whilst in other buildings contain the tinsmiths' and press shops, foundry, the resistance, insulation and coil-winding departments. The parts for the smaller apparatus are assembled on the top floor of the control gear factory, whilst those for the large types of apparatus are sent to the first and ground floors, which

FIG. 5—DRILLING CONTROLLER CAP PLATES

also form assembly departments. The second floor forms the machine shop, which has an area of 25,500 square feet. The ground floor is used mainly for the assembly of contactor panels, automatic sub-station panels, "on-load" transformer tap-changing gear, and ship propulsion equipment.

In the bus-bar section of this department there are special tools for edgewise bending, drilling, forming, cutting and the sweating of bus-bars. With this up-to-date equipment, bus-bars and heavy-current back connections are neatly made, and with fewer joints than were needed when the older methods were in vogue. Smaller controller panels and traction equipments are dealt with on the first floor, whilst, as we have said, the second floor forms the machine shop where there are many interesting and ingenious devices and machines specially developed for quantity production of the many peculiarly shaped parts

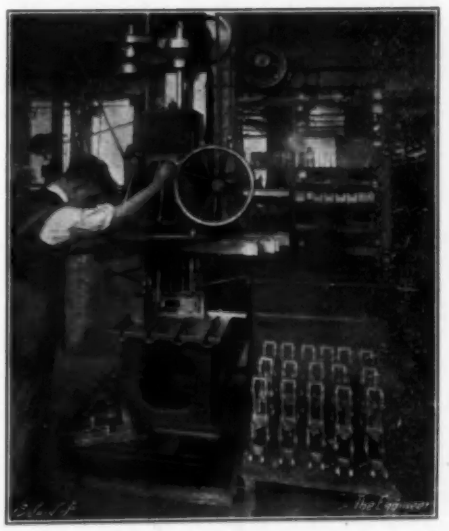


FIG. 6—DRILLING AND REAMERING ON MULTI-SPINDLE DRILL

associated with control gear. The department has been laid out with a view to keeping the material flowing continuously in one direction. Raw material is supplied by a lift at the north end, whilst finished parts are delivered to the inspection department at the south end, where another lift carries them to the assembly section. As far as possible, the general order of machining is (1) turning or turreting, (2) milling, (3) drilling, and (4) tapping. On the assembly floors the material passes in the reverse direction—*i.e.*, south to north—thus giving a unidirectional flow throughout the building.

The simultaneous drilling of several holes in tram car controller cap plates is shown in Fig. 5. The jig is provided with runners and tenons fitting into the table slots, and when the jig is loaded the operator pushes it back to a

stop, which ensures that the jig is correctly located for the drills to enter the bushes. Another application of this machine is shown in Fig. 6. Two sets of tools are set up so that the holes are first drilled with one set. The jig is then reversed, and the holes are reamered with the second set, the holes being so disposed that when the drills are cutting the reamers clear the jig, and *vice versâ*. The milling machines shown in Figs. 7 and 8 demonstrate the use of special milling fixtures and multiple cutters; in Fig. 7 the machine is being used for the first milling operation on cast iron magnet frames, for railway contactors. As the illustration shows, the milling operation is carried out on the "gang" system. One-half of the external machining is done in this manner, and after the casing has been reversed, another gang of cutters completes the

FIG 7—AUTOMATIC MILLING MACHINE

job. The illustration, Fig. 8, shows the milling of operating arms for railway contactors on an automatic milling machine by the index table method. These operating arms are composed of malleable cast iron. Six bosses have to be machined outside, and the pairs of bosses at each end are also machined inside. The arbor carries a gang of cutters to machine two castings side by side, and by using the index table, loss of time is avoided as the operator is loading one jig whilst the cutters are working on the other. By means of dogs the table is automatically controlled, so that the operator has only to raise the starting lever each time, the motion of the table being quick forward, feed, quick return, and stop. Owing to the shape of the centre of the casting, it is impossible to machine right through at one operation, but the jigs have been designed so that four bosses are machined outside and one pair inside in a jig at one end of the table, the remaining pair of bosses

FIG. 8—MILLING CONTACTOR ARMS

being machined inside and out in a jig at the opposite end of the table, and the two jigs are so aligned that the two operations are complementary to one another. This arrangement makes it possible to use the index table with only one jig of each kind instead of a pair of each kind in accordance with the usual practice, so that each casting only pays one visit to the machine before being finished. If two pairs of jigs were used, it would mean matching one end of all the castings first, and then going over them all again to machine the second end. With girl operators, production for the complete cycle of two operations is at the rate of about thirty per hour.

The illustration, Fig. 9, shows a device for the rapid drilling of a single hole in parts, such as controller tips, &c. The basic principle of the scheme is that the downward movement of the spindle as it approaches the work is used to clamp the work in position. The general housing is common to a number of parts, but interchangeable blocks are inserted for each separate article. A barrel attached to the spindle contains a spring plunger to which two pairs of links pivoted on the top of the fixture are pinned. On these links there is an adjustable block carrying another spring plunger, which bears against the work as the drill descends. This second plunger engages with the work, and afterwards further downward movement of the drill is taken up by the spring in the barrel. As the machine is foot operated, the operator has both hands free, and

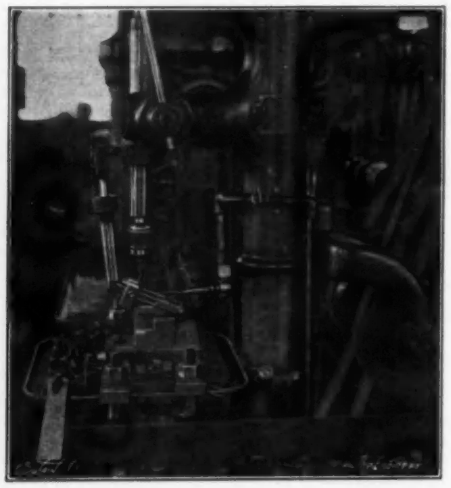


FIG. 9—SELF-CLAMPING JIG

uses the right hand to insert the work and the left hand to operate an ejector lever. It is possible to drill about twenty-five contactor tips per minute, and the method has been applied to two-spindle machines.

As a very large variety of drum controller segments has to be drilled, the special machine shown in Fig. 10 was designed in the controller factory. The two spindles

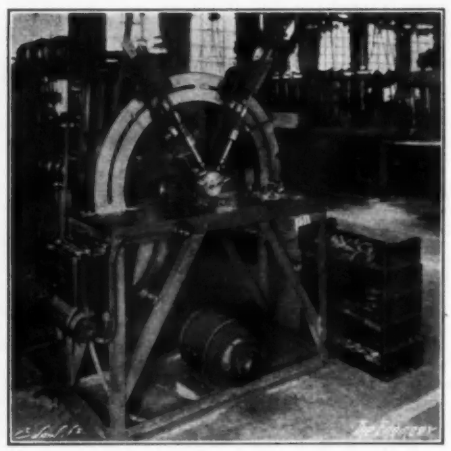


FIG 10—DRILLING CONTROLLER SEGMENTS

can be set at any angle between 18 deg. and 180 deg., the angle being plainly marked on the sector on which the spindles are mounted. Adaptors of various sizes can be inserted at the centre of the circle to accommodate segments of varying widths and diameters. The segments are mounted on their respective adaptors by means of two arms which are also set to a scale of degrees. As the illustration shows, the drive is taken from the motor by a belt passing over the two pulleys and is transmitted to the spindles through two pairs of mitre wheels. As the tool is used as a combined drill and counter-sinking tool, only one operation is necessary to drill and counter-sink both holes in their correct position.

The fixture shown in Fig. 11 is for the rapid tapping of small parts. The tapping machine has a double friction clutch, so that the pressure of the work on the tap causes it to rotate in the direction required for tapping, while on the pressure of the work being withdrawn the machine is caused to rotate in the opposite direction. The fixture consists of a disc with a number of slots into which the work fits. Indexing is obtained by a disc at the handle end with holes which engage with the pin in the top of the fixture when the slot holding the work is opposite the tap. The operator uses his left hand to operate the fixture, and loads up the next slot with his right hand, the work automatically falling out of the jig as the disc rotates for the next part to be tapped. It is unnecessary for the operator to pull the work back to withdraw the tap, as a spring is provided for that purpose, and on small inserts with 6 B.A. blind holes a boy operator can tap 1200 holes per hour.

The fixture shown in Fig. 12 is for drilling cylinders for drum controllers. The cylinder, consisting of the shaft, with various castings assembled upon it, is located in the fixture from the "off" position of the star wheel. The barrel at the left-hand end has one notched disc for each segment of the cylinder, and a notch for each hole to be drilled in the segment. A plunger engages with these slots and so fixes the cylinder in the correct position. Longitudinal location is obtained by a rack which fits inside the fixture, and which is engaged by a similar plunger. The barrel and rack are interchangeable, so that only one drill and bush are necessary for various cylinders.

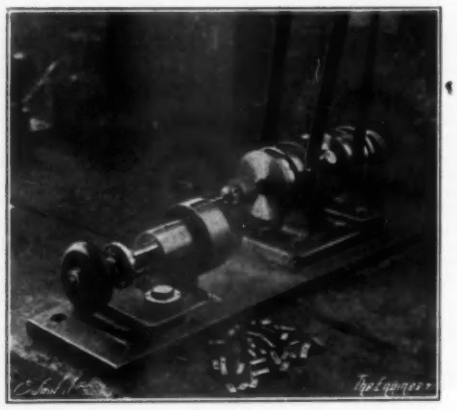


FIG. 11—TAPPING SMALL PARTS

The top floor of the building is devoted to the assembly of controllers—see Fig. 1 on page 600—hand starters, and pillar type starters, and to the winding of resistance tubes. In the latter section vitreous enamelled units are wound on porcelain tubes, and then enamelled in an electrically heated oven—shown in Fig. 2 on page 600—the temperature of which is automatically maintained within predetermined limits. The units are enamelled whilst they are at a red heat, and on completion they will withstand overloading to similar temperatures for comparatively long periods without permanent injury. As the wire is coated with a thick glaze it is impervious to moisture.

An important product of this floor is the firm's pillar type A.C. and D.C. starters. Face plate and drum type starting pillars are manufactured. A.C. pillars, comprising a drum type starter with step-by-step ratchet motion, are made for currents up to 1200 ampères, whilst A.C. pillars equipped with a similar drum type starter for the rotor circuit and a triple pole contactor with an overload relay in the stator circuit are made for currents up to 500 ampères per phase. Owing to the larger quantities of D.C. face plate starters required, special handling by the straight assembly line method is necessary. Starting with the switch base at one end, the complete starters finally emerge at the other end and the number of operations performed by each worker is planned to occupy the same time, so that there is no accumulation of work between

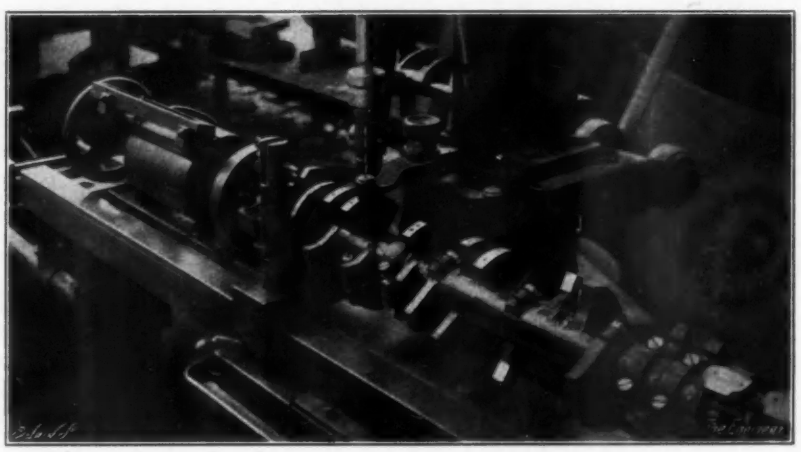


FIG. 12—FIXTURE FOR DRILLING DRUM CONTROLLER CYLINDERS

the operators. The necessary parts required by each operator are stored in suitable receptacles, so that they can easily be reached. At the end of the line, the complete starter is tested, and is ready for packing and despatch. Cast grid unbreakable resistances for crane controllers, trolley omnibuses, tramcars, neutral earthing, &c., are made in a separate building. These unbreakable resistances are composed of continuous wire units formed into grids on a special machine—shown in Fig. 3, on page 600

—the wire or strip being delivered to the works in a continuous coil. First of all, the wire is cleaned ; it is then electroplated to render it proof against corrosion ; after which it is fed into the grid forming machine, from which it emerges as a continuous series of grids, which are coiled directly on to drums to be seen in the foreground of Fig. 3 on page 600. The next operation consists of building the grids into resistance banks, mounted on mica insulated tie rods, with the necessary spacing and insulating washers, after which they are passed on to another section of the department—shown in Fig. 4 on page 600—where the terminals and covers are fitted. If necessary, a number of boxes are bolted together to form a complete unit, and, finally, they are tested for resistance insulation.

B.E.S.A. Specifications.

BRITISH ELECTRICAL STANDARDS.

THREE electrical specifications have recently been issued by the British Engineering Standards Association, two of them being revisions of existing British Standards and the remaining one being a completely new issue. The two revisions are Nos. 37, 1929, Electricity Meters ; and 67, 1929, Two and Three-plate Ceiling Roses, while the new publication is No. 358, 1929, British Standard Rules for the Measurement of Voltage with Sphere-gaps.

B.S.S No. 37, 1929, is the revision of the 1919 edition, and differs from its predecessor in several important respects. In the first place, the permissible limits of error have been appreciably reduced, the limits for all sizes, grades and types of meters now being within the Board of Trade limits. In the second place, differentiation has been made in several important respects between D.C. and A.C. meters, whereas in the 1919 edition there was no differentiation as regards the majority of the electrical performance requirements. Thirdly, two grades of both A.C. and D.C. types are provided for, namely, a Sub-standard grade and a Commercial grade. Fourthly, the registering mechanism is now restricted to the pointer type, and must consist of not less than six pointers. (This clause obviously does not apply to electrolytic meters, nor does it apply to Sub-standard meters with special dials for testing or other purposes.) A useful feature of the specification is a folding sheet containing a summary of the performance requirements. This sheet can be removed from the specification and mounted in the test-room for ready reference.

B.S.S. 67, 1929, the revision of the 1914 edition of the British Standard Specification for Ceiling Roses, differs from the old specification mainly in that the design has been simplified by the omission of the projecting lugs on the contact-plates, and by the contact-plates of the three-plate ceiling rose not being required to be of different shapes. In addition to the two and three-plate surface type ceiling roses, provision is made in the revised edition for semi-recessed ceiling roses, all types being suitable for use in circuits in which the voltage does not exceed 250 volts, and the current does not exceed 5 ampères. The specification lays down the materials and dimensions of the component parts, and details are given of a suitable gauge to ensure that the holes for the fixing screws are so spaced that a British Standard ceiling rose can be mounted on a British Standard conduit box. It is interesting to note that, whereas the old specification restricted the material of the base and cover to " vitreous material," the revision allows the alternative use of " tough non-ignitable insulating material " (mouldings) provided such materials satisfy the requirements of the specification.

B.S.S. No. 358, 1929, British Standard Rules for the Measurement of Voltage with Sphere-gaps, contains the rules prepared by the British Electrical and Allied Industries Research Association, and is a revision and extension of the material originally presented by the B.E.A.I.R.A. in Technical Report No. L/S2. These new Rules supersede the old rules which were given as appendices to several of the British Standard Specifications for Electrical Machinery. The tables given therein have been approved by the International Electrotechnical Commission, and they cover the whole range of voltages from 10 kV to 900 kV with six sizes of spheres. In addition to the tables, a series of curves is included to enable interpolations to be made at any intermediate point with an accuracy equal to the limiting accuracy of the method itself.

Copies of all the new specifications may be obtained, price 2s. 2d. each, post free, from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1.

BRASS ARMOURING WIRE FOR ELECTRIC CABLES.

THE British Engineering Standards Association has recently issued a Specification relating to Brass Armouring Wire for Electric Cables. The wire dealt with in this specification is intended primarily for use in the automobile and similar industries. The specification provides for three sizes of wire, and specifies the chemical composition of the material, the tolerances permitted on the dimensions, and the finish of the wire—mechanical tests are included, and the procedure of selecting samples for these tests is laid down. Copies of the new Specification, No. 356, 1929, may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

THE Canadian House of Commons Railway Committee has approved the plans of the Canadian National Railways for new termini at Montreal costing upwards of 50,000,000 dollars. Construction is to be started immediately and the work is to be completed in seven years. The new termini will eliminate scores of level crossings, give the Canadian National Railways adequate freight and passenger facilities and, with revenue from surface buildings over underground tracks and termini, eventually return 6 per cent. interest on the total investment.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

"No Change."

THERE has been no change of note in the industrial situation in the Midlands and Staffordshire during the past week. Trading has been quiet in all departments and business has been done at similar prices to those ruling a week ago. The market tone is maintained and a fairly good undercurrent of trade is discerned. There has naturally been some lack of initiative on the part of buyers who are anxious to discover which way the political cat will jump before they make their plans for the future. Much, it is claimed, will depend in this area particularly on whether or not safeguarding of industries is to be maintained. Consumers of raw materials are as a rule well bought, producers have no excess of output ; consequently, neither have cause to worry. It is confidently anticipated that next week and the weeks following, the country's Government policy having been decided upon, will see a general renewal of activity in industrial circles and a release of business now being withheld pending more settled conditions. Most of the iron and steel works in this district are now in operation again, and there are reasonable prospects of fairly regular employment in all branches.

Pig Iron.

Purchases of pig iron continue to be confined to small tonnages required for immediate consumption. It is commented upon that even expiring contracts are not being renewed. Indeed, the abstention of pig iron users is a prominent feature of the market. Consumers are evidently convinced that they are more likely to gain by limiting their purchases to current needs than by placing forward orders. The unanimity amongst blast-furnacemen continues and all efforts to secure supplies at below the recognised price level prove unavailing. Blast-furnacemen are able to dispose of their output, and, while the balance of supply and demand remains as at present, there seems little likelihood of their accepting less remunerative prices. Northamptonshire forge iron sells at £3 5s. per ton ; No. 1 foundry at £3 13s.; No. 2 at £3 11s.; No. 3 at £3 9s.; and No. 4 at £3 8s. Derbyshire forge is priced £3 8s. 6d.; No. 1 foundry, £3 16s. 6d.; No. 2, £3 14s. 6d.; No. 3, £3 12s. 6d.; and No. 4, £3 11s. 6d.—delivered at stations in the Black Country.

LATER.

Midland blast-furnacemen, members of the combine, this week advanced prices of all grades of pig iron, with the exception of No. 1 foundry, 1s. per ton. This is the third advance since January, when the combination came into being. The increased cost of production is given as the reason for the latest advance, which brings prices to the following level :—Northamptonshire forge, £3 6s.; No. 1 foundry, £3 13s.; No. 2, £3 12s.; No. 3, £3 10s.; and No. 4, £3 9s. Derbyshire forge, £3 9s. 6d.; No. 1 foundry, £3 16s. 6d.; No. 2, £3 15s. 6d.; No. 3, £3 13s. 6d.; No. 4, £3 12s. 6d.—delivered at Black Country stations.

Finished Iron.

The improvement in the Staffordshire finished iron trade continues, and manufacturers are satisfied that, on the whole, the industry is steadily gaining ground. In the marked bar branch, where little competition has to be encountered, mills are doing well and producers have no difficulty in obtaining the basis price of £12 per ton for their output. Considerable headway needs to be made in the Crown bar department before a satisfactory state of affairs can be said to exist. Certainly business is better than it has been, and prices, which range from £9 10s. to £10, are higher than for some time. Competition from outside sources remains severe, but local ironmasters claim that with their superior product they are securing a fair portion of the " good-class " business. With a difference of £2 per ton between Staffordshire makers, prices for nut and bolt bars and Belgian No. 3 iron, used for a similar purpose, it can hardly be expected that local ironmasters can successfully compete. Belgian bars were offered in Birmingham this week at a little below £7 2s. 6d. delivered. Native makers cannot supply at less than £9 to £9 2s. 6d. Not only are the cheap iron bars imported, but considerable quantities of finished nuts and bolts are being dumped in the district. Demand for wrought iron tube strip endures and values are maintained at £10 17s. 6d. per ton.

Steel.

The steel trade has settled down again after the price revision, and buying of structural material is taking a normal course. Constructional engineers in the Midlands are far from busy however, and their requirements are small. Moreover, many took the precaution of getting supplies in hand in anticipation of the recent price increase. Competition for structural engineering work is very keen. The number of firms in the trade has increased considerably during the past few years, and there is such a scramble for the available business that prices are cut till the work returns no profit. Plates are in more active request, ship, bridge, and tank plates making £8 17s. 6d. and boiler plates £9 15s. In the half-products branch business has fallen away slightly, due probably to increased competition from the Continent. Imported bars are to be bought round about £7 per ton, which is some 30s. below the price at which local mills offer supplies. Birmingham merchants are not at all satisfied, however, with the volume of business they are doing in foreign material. They consider it should be far greater, taking into account the price disparity. Foreign billets of 2½in. upwards are offered at £6 per ton against the district price of £6 10s. and the Welsh price of £6 7s. 6d. There is a good demand for steel strip at £8 10s., and here, again, makers have to contend with continental material offered at 20s. per ton less. The effect of the rise in finished steel prices on demand, and particularly on imports, is being closely followed. It is, of course, too early after the acceleration to expect to observe any marked results. Steelmasters hereabouts express confidence in their ability to hold business recently won from the foreigner.

Galvanised Sheets.

The revival of demand for galvanised sheets has been but temporary. This week has witnessed a decided falling off of orders on both home and export account. Mills, however, are moderately placed, and as a result are enabled to stand out for the price to which galvanised sheets was recently raised. Local mills generally quote 24 gauge corrugated sheets £13 15s. f.o.b. Liverpool for export and at works for home consumption. South Wales-sellers are prepared to do business at half-a-crown below this figure. Values of thinner gauge sheets are held at recent levels.

British Industries Fair.

The popularity of the heavy industries section of the British Industries Fair, held yearly in Birmingham, and the fact that previous exhibitors have been well satisfied with results, is clearly demonstrated by the fact that arrangements for next year's Fair are even more advanced than at the corresponding stage of organisation last year. No less than 60 per cent. of the available space has already been let. Manufacturers and engineers will be pleased to learn that Mr. C. Elliott, who for the past three years has taken a prominent part in the organisation of the heavy industries display, has been appointed to the position of general manager of the Birmingham section, in succession to the late Mr. Charles Stanley. Mr. Elliott was assistant locomotive superintendent of the Great Central Railway in the Sheffield district, was chief engineer of a large chemical works in North Wales, and has been in private practice as a consulting engineer in Manchester.

Water Engineers.

The Institution of Water Engineers, which was established thirty-three years ago, the annual general meeting of which was held last week in Birmingham, has now a membership of about 600, composed in the main of the engineers in the service of over 200 water authorities and companies, with an aggregate capital exceeding £160,000,000. Engineers attending the conference have visited many works of interest, including the Severn syphon of the Elan aqueduct, the Prestwood pumping station, Bartley reservoir, Frankley works, and the Birmingham waterworks at Elan Valley.

Ironbridge Power Station.

Work commenced this week on the first section of the great power station at Ironbridge, which, as has already been explained in these columns, will be one of the powerful base load generating stations for the whole of central England.

Obituary.

Midland industrialists will regret to hear of the death on Monday last of Mr. Arthur Richards, J.P., of Wednesbury. Mr. Richards, who was in his sixty-seventh year, was well known and highly respected in this area. He was associated with the firm of Charles Richards and Sons, Imperial Works, Darlaston. The firm, in the development of which he played an important part, is one of the largest privately owned companies in the nut and bolt trade in the country, upwards of 1200 employees being engaged. Mr. Richards was a director of the Midland Bolt and Nut Company, the Criterion Stamping Company, and the Newport Rivet Company.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

£10,000,000 Water Supply Scheme.

THE Manchester Waterworks Committee decided at a meeting this week to recommend the City Council to sanction an immediate start being made with the first portion of the waterworks scheme at Haweswater, in the Mardale Valley, Cumberland. It is estimated that the total cost of raising the level of the waters of the lake and of other work to be carried out will be between £10,000,000 and £12,000,000. Of that sum the first portion of the scheme will absorb about £5,500,000, mainly on the construction of roads and the provision of housing accommodation and equipment of various kinds. Two important features of the scheme are the construction of a dam at the lower end of the lake, which will add about a mile to its length, and the boring of a tunnel to carry water from Haweswater to the existing lake for the purpose of augmenting the Thirlmere supply. Mr. Holme Lewis, the waterworks engineer, explained that the first work to be undertaken would be that of road construction, for which the City Council are to receive a grant in aid from the Government. Employment will be provided for about 700 men. It is expected that the entire scheme will be completed by 1934.

Girder Bridge Collapse.

Colonel Trench's report on the collapse of a light lattice girder bridge on the London, Midland and Scottish Railway line between Bispham and Blackpool, is now in the hands of the Minister of Transport. The accident occurred in January last, and three of the seven workmen who were injured died later. The two main girders of the bridge fell on a passing train, though none of the passengers or railway staff was injured. Colonel Trench's opinion is that the probable cause of collapse was the toppling outwards of one of the girders caused by the movement of the men on it, the girder being in an unstable condition without adequate lateral support about the

centre of the span after the removal of the top bracings. Comment is made as to the quality of the steel girders. The steel in the girders, Colonel Trench states, was of inferior quality, and did not comply with either A or B grades of British standard specification No. 15 for structural steel, to which it was inferior in tensile strength and in chemical composition, while the method of manufacture did not comply with that laid down for a steel which alone should be used for bridge work. He adds, however, that assuming that the originating cause of the collapse of the bridge was a toppling over, the results would have been much the same had both material and workmanship been in accordance in every way with the British standard specifications. In Colonel Trench's opinion, the contractors did not sufficiently appreciate the extreme lateral instability of the girders during the short period when they were being separated into their final positions.

Fleetwood Developments in View.

It is reported that the negotiations between the Fleetwood Town Council and the War Office for the purchase from the latter of about 108 acres of land on the Fylde seaboard are approaching the stage of completion. If the deal goes through, the Town Council proposes to extend the existing promenade for over a mile and to effect a junction with the promenade behind the sea defence wall, which is now practically completed. The land has been used by the War Office as a rifle range and military training grounds, and proposals have been made to utilise some of the buildings for the manufacture of artificial silk or for other industrial purposes.

Business Notice.

At an extraordinary general meeting of Broughton Copper Works (1928), Ltd., held in Manchester this week, a proposal to change the name of the concern to "The Broughton Copper Company, Ltd.," was passed as an extraordinary resolution, and will be submitted for confirmation as a special resolution to a further extraordinary general meeting to be held in June.

Mersey Tunnel Inspection.

Members of the Institution of Municipal and County Engineers, on the occasion of their annual conference at Buxton in June, are to inspect the new tunnel under the river Mersey between Liverpool and Birkenhead, which has been in course of construction for about three and a half years. When completed the total cost will have been in the neighbourhood of £5,000,000.

Non-ferrous Metals.

More interest has been displayed in the non-ferrous metals this week, although uncertainty and a good deal of weakness is to be observed in practically every section of the market, spelter being about the only exception. A week ago it was noted that the fact that one of the big American copper producing concerns proposed to curtail its output had had a "bullish" influence on prices of the metal. The effect of this, however, seems to have passed, for virtually the whole of the ground then gained has since been lost, and values at the moment of writing are only fractionally above the levels current a fortnight ago after the sudden slump. In the case of tin, there has been a fair demand about, but here again prices have given way and have reached new low levels. Lead has been moving only in moderate quantities, and quotations are easier on the week to the extent of about 5s. a ton. With regard to spelter, inquiry in this section of the market has been fairly active, and the tendency of prices at the moment is distinctly firm, largely on reports of developments in connection with continental marketing schemes. On balance, prices are higher on the week by about half-a-crown a ton.

Iron and Steel.

Good deliveries of foundry iron are again being taken by Lancashire users, and interest this week has been centred on the advance of a shilling a ton in Midland varieties, bringing current quotations for deliveries of Derbyshire and Staffordshire brands of pig iron to users in the Manchester zone to 72s. and 73s. per ton respectively. Cleveland iron is very firm, but in view of the fact that East Coast makers are offering very little prices are more or less nominal at about 83s. delivered. Scottish iron is not attracting much attention locally, but values are maintained at 90s. to 91s. per ton, with West Coast hematite meeting with a quietly steady demand at 87s. A moderate trade is passing in manufactured iron, with prices steady but unchanged at £10 10s. per ton for Lancashire Crown bars and 10s. less for second quality material Constructional engineers are mainly specifying for material to cover early requirements, which, however, are much less extensive than they should be at this time of the year. The demand for plates by boiler makers is slow, but locomotive engineers are taking fair supplies against contracts. Except for special quality bars for bright-drawing purposes, which continue to sell in good quantities, the demand for steel bars this week has been on quiet lines. Prices are very firm, with sections and joists quoted at £8 2s. 6d.; tank plates at £8 17s. 6d.; large diameter bars at £9 2s. 6d.; boiler plates at £9 12s. 6d. to £9 17s. 6d., according to quality; and small bars at £8 7s. 6d. to £8 10s. per ton.

BARROW-IN-FURNESS.

Hematite.

There is no change in the hematite pig iron market, which continues to maintain a healthy tone. Makers are clearing most of their stocks, either on account of immediate requirements or as regards orders for forward delivery. There is a certain amount of regular continental trade, and the business with America is not completed yet, there having been a further dispatch of pig iron *vid* Philadelphia last week, while further cargoes are due away in a week or two. The fact that the steel departments are taking a fair tonnage every week limits the amount of iron available in the case of some works. Business in special qualities continues to be satisfactory. General inquiries continue to be encouraging. The iron ore trade is steady, and the business done outside the district has improved recently. Foreign ore is being imported in regular quantities, the demand during the last few months having slightly increased. The steel trade is moderate, but a few orders are booked which will keep the rail mills going for some time. The hoop works are well situated, and are engaged on orders mostly on overseas account.

Rumours of Combine.

It is difficult to ascertain actual facts, but certainly there is some talk of combining amongst some of the iron producers. Whether the discussions are on a national or local basis it is difficult to say at the moment, but it is rumoured that certain proposals have been discussed, and it is possible that in the early future something definite may be made public. In the meantime the utmost secrecy is maintained, and it is impossible to give details.

SHEFFIELD.

(From our own Correspondent.)

Steel Trade Features.

IT is difficult to generalise with regard to conditions in the iron and steel industries of the Sheffield district. In some departments a steady expansion continues, while others are experiencing a slight decline in trade, and some which have been very slack for a long time are finding it difficult even to maintain their present poor position. On the whole, probably the falling off is very slight, but the situation is not easy, and the tendency for certain prices to increase does not help matters. The time is considered very inopportune for any higher prices to be introduced, there being a danger of losing business, and billet makers have been strongly criticised by re-rollers and others for advancing their prices. Whilst it is admitted that production costs have been increased by the advance in prices of scrap, it is suggested that savings in overhead and other expenses have gone far to balance these. It is pointed out that since the advance in the price of British billets, certain classes of continental steel have been offered at rather attractive rates, with the result that some purchases have been made. Although such competition is not considerable at present, no opportunity should be provided for it to increase.

Basic and Acid Positions.

Principal activity continues to be in connection with basic steel, and Lincolnshire works engaged wholly on this are in an excellent position. They are working at full capacity, and prospects are stated to be quite good. In the Sheffield district, however, the demand for basic steel is not quite so good as it was a few months ago, and the output of open-hearth steel has fallen off considerably recently, a few large furnaces having been put out of commission. At Parkgate, however, the open-hearth plant is fully employed. The production of acid steel is comparatively small.

Labour-saving Machines.

As mentioned last week, the Park Gate Company has brought about considerable economies by the introduction of new plant, including a complete battery of gas machines for open-hearth furnaces. Most of the open-hearth plants in Sheffield have adopted this machine—known as the Wood gas machine—and, although they are well satisfied, they have not been able to profit so much from the new system as the Park Gate Company, because they have been unable to keep their furnaces in full operation. The machines mean a great saving in labour, and many workmen have been displaced by them. Incidentally, it is interesting to note that unemployment figures on the whole are better, the resumption of work after the holidays having been more general than in previous years, but it is stated that several hundreds of employees at one large steel works in Sheffield have been given notice. That step, however, is due to reorganisation and not to the state of trade. The majority of the men to be discharged have reached the pensionable age.

New American Tariffs.

Considerable interest is being aroused by the provisions of the new United States Tariff Bill. Imports on which the duties have been altered, generally in an upward direction, include pig iron, wire rod, wire rope, tungsten ore, hollow drill steel, high-speed steel, safety razor blade strips, chains and cast iron pipes. The new alloy cutting tools are an addition to the list of dutiable articles, the duty being fixed at 60 per cent. A well-known local firm has received an interesting letter from the president of an American firm concerning a number of the sections of the new Tariff Bill, and it is suggested that the United States is endeavouring to prevent the importation of high-speed steel scrap, as well as alloy steel products. It shows that the Chairman of the Ways and Means Committee, commenting upon the Metal and Manufacture Schedule, states: "We have revised the phraseology covering iron and steel scrap so as to prevent the importation of high-priced metallic elements as constituents of scrap at the lower rate of duty. We have also incorporated new phraseology to take care of sponge or granular iron, which is a comparatively new product in the United States, and not specifically mentioned in the present Act. The provisions for alloy steel products have been expanded to carry out the established policy of special tariff treatment for alloy steels, so as to embrace the entire range of alloy materials and the products of which they are important components, and the phraseology has also been changed to provide for alloys contained in iron. Provision has also been made for assessing higher rates of duty on chromium or vanadium in steel or iron."

New Uses of Steel.

It is suggested that a considerable improvement in trade may follow the adaptation of steel for new purposes. Since the war, the growth of the motor industry has accounted for the annual use of thousands of tons of steel, and it is expected that the development of civil and commercial aviation will bring a further demand. The use of steel for railway sleepers and rolling stock may also develop before very long, for experiments are now being carried out by British companies in connection with steel sleepers, and the L.M.S. railway alone has now 500 all-steel vehicles in use. The Mining Association is conducting a complete investigation into the possibilities of a more general use of steel pit props and roofs in mines, and there is a suggestion that steel furniture is coming into more general use.

The Lighter Trades.

Conditions in the cutlery and plate trades do not improve, and most departments are slack. The safety razor blade manufacturers are doing well, however, and it is worthy of note that the sales of these blades have increased to the extent of nearly 300 per cent. since 1926. Hotels and shipping companies have placed several orders for cutlery, but these are divided among a few firms who make a special feature of meeting their needs.

NORTH OF ENGLAND.

(From our own Correspondent.)

The Trade Position.

DESPITE the disturbing influence of the General Election, the trade position generally in the North of England is remarkably sound, and the outlook very encouraging. In the coal trade there is something like a boom, and the market is expected to remain good throughout the year. The markets lost in France, Italy and Sweden are being recaptured, and, with the addition of increased demands from other countries and home sources, the position is such that practically every pit in Northumberland and Durham is working to capacity. One pit, which at the beginning of the year was working only two days a week, is now at full pressure, and the daily output of 10,000 tons is distributed as soon as it reaches the surface. Encouraging accounts are also given of the iron and steel trade, and the strength of the position is further revealed by the announcement of the prospective re-starting of the plate mill at the Malleable Works, Stockton-on-Tees. It is also confirmed that the Jarrow Ironworks will be re-started early in June, while to supply the blast-furnaces the Grinkle ironstone mine in the Cleveland district is being re-opened.

Cleveland Iron Trade.

Much activity is expected in the Cleveland pig iron trade as soon as the disturbance of the election is past. In the meantime producers are not at all concerned by the lull in business. They have excellent order books, and can afford to wait. Home consumers are understood to have a good deal of buying to do, and improvement of inquiry from overseas encourages hope of early expansion in export business. Cleveland pig iron continues very scarce, and an expansion of output is urgently needed. One or two blast-furnaces now idle are expected to be re-started shortly, but as conditions do not admit of enlargement of output to an extent sufficient to cope with the already large and steadily increasing requirements, prospects of relief in the stringent position is remote. Terms of sale vary somewhat, but it is difficult to purchase No. 3 grade of iron below 70s., and other qualities may be quoted in proportion. Thus No. 1 is 72s. 6d., No. 4 foundry 69s., and No. 4 forge 68s. 6d.

Hematite Pig Iron.

East Coast hematite pig iron is not so scarce as Cleveland iron, but there is very little on offer. Makers are fully sold to the end of June, and have no saleable stocks to fall back upon. Second-hand holders are fairly well bought, but they are not disposed to sell extensively, as quotations are low in comparison with prices obtainable for Cleveland iron, and are expected to advance. Business in hematite is reported at 74s. and upwards, according to quality. Thus purchases can be made at only 4s. above the price of No. 3 Cleveland, whereas the normal pre-war difference was 8s. to 10s. Both home and foreign consumers are buyers at the figure named.

Ironmaking Materials.

Foreign ore merchants are not altogether inactive, but they are not making large or numerous sales. They have not much to offer, and, indeed, a serious shortage is predicted if the demand increases to any extent. The output at several places is stated to be barely sufficient to meet current needs, and stocks are understood to be low. Values are very still, and are ruled by the price of best Rubio, which is not below 23s. c.i.f. Tees, and, in fact, more is being asked. Durham blast-furnace coke is anything but plentiful. Sellers are disinclined to name below 19s. for good medium qualities delivered to local consumers, and they hint at higher terms being asked shortly.

Manufactured Iron and Steel.

There has not yet been time to test the market since steel prices were advanced, but buyers appreciate that the new quotations are fixed minima, and that there will be no hope of obtaining supplies below this figure. Moreover, the rebate system prevents foreign purchases, and as steelmakers have heavy order books they can afford to wait. Producers of manufactured iron are turning out a lot of work, are well sold ahead, and are booking new orders in good volume. Semi-finished steelmakers are running plant at high pressure in order to satisfy the needs of consumers, while the works engaged on the production of finished steel have not been so active for many years past. All quotations are steadily firm, and upward movement in prices of some commodities is looked for.

The Coal Trade.

A very favourable situation characterises all sections of the Northern coal and coke trade, and there is a remarkably good market at the present time. Particularly satisfactory is the fact that the strength has not come with a spurt, and therefore is not attributable to some more or less transitory cause, but has come by almost imperceptible, though very real, stages. The buying has been on a gradually expanding scale, and prices have advanced by "coppers" per ton, and have held to the new level. It has been very good for the collieries, but there may have been many a hard experiment for exporters who sold months ago and were uncovered, and subsequently had to come on to an inflated market to meet their obligations. This week, for instance, business in coking coal has been done at 16s. 6d. for June delivery, but it would be a reasonable surmise to say that the purchaser abroad would not pay this higher figure. This is a class of coal that has gone up about three shillings a ton this year. In a generally sound coal position, Northumberland best steams have asserted themselves to the extent of being able to command higher prices. They have been steady for weeks past; then they became decidedly firmer, and now fitters are asking 15s., whereas 14s. 6d. was accepted in the early part of May. In second-hands Blyth bests could not be bought under 14s. 9d. One group of collieries is reported to have sold its output for this year, and others are very heavily booked. The inquiries point to a good forward trade. Instead of becoming easier in tone as the summer season advances, Northumberland steams are stronger than at the beginning of the year. Fitters now ask a firm 14s. 9d. to 15s. for Blyth bests, and Tyne primes are doing equally well at 14s. 3d. to 14s. 6d., and other classes at 13s. 6d. Steam smalls are also very firm at 9s. to 10s. for leading qualities. Durham steams are selling freely at 18s. to 18s. 6d. for large and at 12s. to 12s. 6d. for smalls. Gas coals are in heavy demand, despite the time of the year, and bests are fully 15s. 9d., while specials are 16s. to 16s. 6d. Secondary grades are firm at about 15s. 6d. Bunkers are very strong for best qualities at 16s. 6d. to 17s. 3d. Other brands are 16s. The demand for coke is steadily expanding. Gas coke is scarce, and the few available parcels are quoted at a firm rate of 21s. Patent cokes are steady, and despite ample stocks, are unchanged at 18s. 6d. to 19s. Beehive and special foundry cokes command 26s. to 28s. 6d.

French Industrialists on Tyneside.

Prominent French industrialists, on a visit to Tyneside this week for the annual meeting of the Alliance Française, took the opportunity of having informal talks with leading coalowners and agents on the question of increased trade between this country and France. While French consumers are sympathetic to Northumberland and Durham coal, they desire to see England take more French pitwood and iron ore. Reciprocal development was therefore the chief object of the conversations. France is, of course, taking more British coal now than for some years past. In March it amounted to over a million tons, an increase of a quarter of a million tons on the January figures. Much of this coal was shipped from North-East Coast ports.

SCOTLAND.

(From our own Correspondent.)

Coal Distillation.

THE first Bussey low-temperature carbonisation plant, which has a capacity of 600 tons per day and is being erected by the Bussey Coal Distillation Company, Ltd., at Glenboig, near Glasgow, will come into operation within the next week or two. An examination of Scottish coals has shown that the fuels which will give the most satisfactory results when treated by the Bussey process, not only in ease of working, but also in their yield of oil and quality of resultant smokeless fuel, are available in the district of Glenboig. Contracts have been entered into for the sale of the whole of the gas and oil from the Glenboig plant. Contracts have also been entered into for the erection of five Bussey plants, with a total daily capacity of 2500 tons, and further contracts for plants capable of treating 10,000 tons per day are under consideration.

Steel.

Steel makers still experience some difficulty in keeping their mills employed, specifications for plates being particularly scarce. The increase in prices of plates and sections intimated last week has had little effect on business so far, though it is said that there has been a little more inclination on the part of consumers to cover their requirements. Light steel sheets have a moderate turnover, but heavy varieties are quiet. Tube makers are still actively employed in all branches.

Iron.

Bar iron is in very restricted demand, and re-rolled steel bars are not a great deal better off. Prices of the former are unchanged, despite higher costs of production, while the latter are still quoted in the region of £8 home and £7 15s. per ton export.

Pig Iron.

Business in pig iron is quiet generally, and supplies are readily obtained. Prices are unchanged.

Scrap.

The market for scrap remains firm. Supplies are, as a rule, scarce, and quotations are maintained. Heavy steel scrap is nominally 77s. 6d. and heavy basic 72s. 6d., and there is a possibility of higher prices being quoted.

Coal.

The position of the coal trade has not improved during the past week. Export business continues on very quiet lines, and home demands are low. Supplies of large coal, as a rule, are more than adequate, and with few exceptions prices are a matter of arrangement. Considerable idle time is reported, and Lanarkshire appears to be most hardly hit in this respect. Washed materials are, on the other hand, comparatively steady, with trebles and doubles the strongest features, especially in the east of Scotland. Aggregate shipments for the week amounted to 246,007 tons, against 268,206 tons in the preceding week and 272,268 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

THERE has been an improvement in the general conditions prevailing in the steam coal trade during the past week as the result of the better arrival of tonnage. Last week the conditions were anything but satisfactory, as may be gauged by the fact that on Saturday, if Swansea and Port Talbot be excepted, there were eighteen tipping appliances idle, and only three steamers waiting. At Swansea the position was quite unusual, as there were fourteen steamers waiting to load, while at Port Talbot there were three. As the result of week-end arrivals, the situation on Monday, taking the whole of the ports, was that seven tips were idle, while twenty-seven vessels were waiting to get into berth. The improvement is so marked at Swansea that, partly as the result of the increased activity in the export trade, and partly on account of the pressure of the Swansea Chamber of Commerce, the Great Western Railway Company, following upon negotiations between the company and the tippers' and trimmers' unions, opened on Monday the South Dock. Work had been suspended at this dock for some time past on account of the depression in the export line. So far as the steam coal section is concerned, there does not appear to be a great deal of inquiry from abroad, and yet there is no doubt that the position is better than it was a week or so ago. It is probable that the action of the coalowners in putting up minimum prices has had some influence upon buyers. The fact that business is held is shown by the demand for tonnage. The freight market keeps wonderfully steady, partly owing to the quietness of homeward business and partly to supplies of tonnage being so sparingly offered, and, as a consequence, being readily absorbed. One noticeable feature is the inquiry for coals for delivery at destinations which may be described as a little off the beaten track. This certainly points to coals from this district getting more into favour. Although no new big contracts are reported, it is understood that the Portuguese State Railways have bought 15,000 tons of superior smalls for delivery over the next three months, while the New Zealand Government is inquiring for 30,000 tons of superior steam coals. It is feared, however, that this business will go to the North instead of being placed for Welsh coals.

Coal and Patent Fuel Developments.

For several weeks past the coal market has been busy with rumours regarding highly important developments in the direction of closer association between leading combines in this district. The matters referred to include, not only the production, but the export and the inland distribution of supplies of coals. There is nothing official forthcoming so far, but in the case of the patent fuel industry of South Wales, developments which are afoot are practically admitted. It became known at the end of last week that there was a common policy so far as prices of patent fuel were concerned, the minimum price for Swansea brands being 20s. and for Cardiff and Newport brands 21s. to 21s. 6d. These prices were not fixed by the Patent Fuel Manufacturers' Association. It appears that much more is involved, and that for a long time past negotiations have been in progress for reorganising this industry. The object of these negotiations is not merely to bring the whole of the manufacturers into line so far as policy is concerned, but to ensure that all the companies should be consolidated into one, with one selling agency. By this means production can be regulated and concentrated, and a great saving in costs effected. It is an ambitious project, but competition with foreign manufacturers during recent years compels the taking of some steps in the direction of reorganisation, if this important industry is to hold its own and is to make progress. Its importance to the coal trade is unquestioned. It is pointed out that for every ton of patent fuel produced 18 cwt. of small coal is required. During 1928 the quantity of patent fuel shipped abroad from this district was 1,025,912 tons, of which 569,741 tons was from Swansea, 321,815 tons from Cardiff, 116,009 tons from Newport, and 18,347 tons from Port Talbot. Going back to 1913, the total quantity exported was over 2,000,000 tons. At the present time there are seven separate patent fuel companies in this district.

Current Business.

With tonnage in rather better supply, the inquiry for coals has displayed some expansion, and the position of collieries on the whole is certainly better. Some collieries are very full indeed, mainly those producing the superior grades. It cannot be denied, however, that so far as the lower grades are concerned, there is some irregularity in values for prompt loading. Shipments this week will, of course, be in advance of the total for last week, when returns were affected prejudicially by the holidays, and only amounted to just under 350,000 tons, as against nearly 460,000 tons the previous week. Large coals are in relatively better supply than smalls, which are rather on the scarce side. Patent fuel shows no improvement in demand, but coke is readily absorbed. Pitwood continues quiet and keeps about 25s. 6d. to 25s. 9d.

THE value of new aluminium produced in the United States during 1928 was 47,899,000 dollars, an increase of 22 per cent. as compared with 1927.

CATALOGUES.

BRITISH THOMSON-HOUSTON COMPANY, Ltd., Rugby.—Descriptive list No. 2420-C on rotary converters.

BUDENBERG GAUGE COMPANY, Ltd., Broadheath, near Manchester.—Catalogue Section 27 of thermometers.

W. CHRISTIE AND GREY, Ltd., 4, Lloyd's-avenue, E.C. 3.—A pamphlet dealing with the prevention of vibration and noise.

L. F. NORRIE AND CO., 30, South Fort-street, Bonnington, Edinburgh.—Descriptive pamphlets of safety and sluice valves.

C. REDMAN AND SONS, Ltd., Parkinson-lane, Halifax.—General catalogue of lathes, boring machines and planing machines of all sizes.

UNDERFEED STOKER COMPANY, Africa House, Kingsway, W.C. 2.—A brochure dealing in detail with the "L" type stoker.

DAVEY, PAXMAN AND CO., Ltd., Aldwych House, Aldwych, W.C. 2.—Catalogue 952, illustrating and describing heavy fuel oil engines.

BRITISH ALUMINIUM COMPANY, Ltd., Adelaide House, King William-street, E.C. 4.—Booklet on "Aluminium Chemical Plant," by Mr. Edgar T. Painton.

BEECROFT AND PARTNERS, Ltd., Mappin-street, Sheffield.—The fourth edition of the firm's "Handbook for Foundrymen, Engineers, Iron and Steel Workers."

RANSOMES AND RAPIER, Ltd., Ipswich.—New publication on the R. and R. petrol-electric mobile cranes, illustrating some of the varied uses to which these cranes can be put.

WELLMAN, SMITH OWEN ENGINEERING CORPORATION, Victoria Station House, S.W. 1.—Catalogue Section V., Part XII., of industrial furnaces for all purposes of heat treatment.

E. C. BROOKES VOS, 2, Moor-street, Birmingham.—A publication relating to "Rubel" bronze and "Admos" alloys, for which products Mr. Brooks Vos is the sole agent in this country.

ECO POWER, Ltd., 15, Lincoln's Inn-fields, W.C. 2.—A brochure describing the "Foster" economiser, its construction and operation; illustrations are given of various installations in this country.

SIR W. G. ARMSTRONG, WHITWORTH AND CO., Ltd., Kinnaird House, Pall Mall, S.W. 1.—Brochure No. 390, dealing in general with the firm's products. The booklet is plentifully illustrated and is printed in English, French, and Spanish; also a pamphlet illustrating A.-W. pneumatic tools.

NEGRETTI AND ZAMBRA, 38, Holborn Viaduct, E.C. 1.—"New Catalogue of Engineering and Industrial Instruments E 5"—consisting of 460 illustrated pages of instruments supplied by the firm. A brief description is given in non-technical language of the operation and use of each instrument. A comprehensive index and some useful tables are included in the book.

CONTRACTS.

THE A-S REFRIGERATING MACHINES, Ltd., one of the associated companies of the General Electric Company, Ltd., has received an order from Boots, Ltd., of Nottingham, for fourteen sectional refrigeration cabinets, each fitted with an hermetically-sealed, leakage and explosion proof A-S automatic refrigerating machine.

THE PATERSON ENGINEERING COMPANY, Ltd., of Windsor House, Kingsway, London, W.C. 2, has received through the Jardine Engineering Corporation, Ltd., of Hong Kong, an order for a rapid filtration plant of 10,000,000 gallons daily capacity for the Canton Municipal Waterworks. The plant will embody three electrically-driven low lift pumps, each with a capacity of five million gallons per day, two to be working and one to act as a standby.

THE PARSONS OIL ENGINE COMPANY, Ltd., of Southampton, have received the following orders:—(*a*) For a "straight-eight" 4½in. series (L8M) engine with built-in reverse gear, from the James Dredging Company, for an inspection launch for harbour work; (*b*) for a four-cylinder 30 horse-power paraffin marine set (L4M) for a ship's motor lifeboat, from Harland and Wolff; (*c*) for four emergency lighting sets of 30 kW for cross-Channel boats being built by Messrs. Denny, of Dumbarton; and (*d*) for air compressing and lighting sets for three Silverline boats.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THOS. W. WARD, Ltd., of Sheffield, ask us to announce that they have arranged to take down the Erewash Blast-furnaces, near Ilkeston.

J. G. WHITE AND CO., Ltd., of 9, Cloak-lane, E.C. 4, ask us to announce that it has opened administrative offices in the Equitable Trust Company's Building, 39, Rue Cambon, Paris. They are under the management of Mr. R. L. McClure, a director of the company.

WILLIAM ASQUITH, Ltd., of Halifax, asks us to announce that it has purchased the patterns, drawings, goodwill and patent rights in connection with the vertical keyseating machines and horizontal duplex cotterway machines of Smith and Coventry, Ltd., and that these machines will, in future, be made and supplied by it, William Asquith, Ltd.

MR. I. D. SCAIFE, M.I. Mech. E., formerly works manager of Ransome and Marles Bearing Company, Newark-on-Trent, has now joined the Heald Machine Company, of Worcester, Mass., U.S.A. Mr. Scaife has recently returned to England from the States, and will act in association with Alfred Herbert, Ltd., of Coventry, the sole agents for the sale of Heald machines.

NEWCASTLE ADVERTISING CONVENTION.—For the first time since the International Advertising Convention held at Wembley in 1924, a session on behalf of the trade and Technical Press has been organised as a definite feature of the Convention. This session, which will be known as the "Industrial Press" Session, will be held in the afternoon of Monday, June 17th next, at Newcastle-upon-Tyne, and will deal with matters of extreme importance to the proprietors of journals coming within this sphere. The main subject to be dealt with is "The Quest of Markets," and under the chairmanship of Sir Edward Iliffe, Bart., C.B.E., the undermentioned speakers have been secured: Sir Gerald Chadwyck-Healey, Bart., C.B.E., chairman, Morgan Bros. (Publishers), Ltd.; Victor Watlington, M.B.E., M.I.E.E., A.C.G.I., managing director, English Electric Company, Ltd., Chairman, British Electrical and Allied Manufacturers' Association; E. M. I. Buxton, Paul E. Derrick Advertising Agency; Percival Marshall, Percival Marshall and Co., Chairman, P.T.P. and W.N.P.A.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
(1) Native	19/6 to 21/-
(1) Spanish	21/6
(1) N. African	21/6
N.E. Coast—	
Native	18/- to 21/-
Foreign (c.i.f.)	23/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	3 18 0	—
No. 1 Foundry	3 15 0	—
No. 3 Foundry	3 12 6	—
N.E. Coast—		
Hematite Mixed Nos.	3 14 0	3 14 0
No. 1	3 14 6	3 14 6
Cleveland—		
No. 1	3 12 6	3 12 6
Silicious Iron	3 12 6	3 12 6
No. 3 G.M.B.	3 10 0	3 10 0
No. 4 Foundry	3 9 0	3 9 0
No. 4 Forge	3 8 6	3 8 6
Mottled	3 8 0	3 8 0
White	3 8 0	3 8 0
Midlands—		
(3) Staffs.—	(*Delivered to Station*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 11 0	—
" " Foundry	3 13 6	—
(3) Northampton—		
Foundry No. 3	3 10 0	—
Forge	3 6 0	—
(1) Derbyshire—		
No. 3 Foundry	3 13 6	—
Forge	3 9 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 12 6	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 4 6 (*a*) / 4 7 6 (*b*) / 4 11 0 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
Lancs.—		
Crown Bars	10 10 0	—
Second Quality Bars	10 0 0	—
Hoops	13 0 0	—
S. Yorks.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
Midlands—		
Crown Bars	9 15 0 to 10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	9 0 0 to 9 2 6	—
Gas Tube Strip	10 17 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ½in. and up	8 12 6	7 12 6
Sections	8 2 6	7 2 6
Steel Sheets, ¼in.	9 0 0	8 12 6
Sheets (Gal. Cor. 24 B.G.)	13 10 0	13 12 6 to 13 15 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 12 6	—
Angles	8 2 6	—
Boiler Plates	12 15 0	—
Joists	8 2 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 0 0	—
Light Rails	8 5 0 to 8 10 0	—
Billets	6 15 0 to 9 10 0	—
Manchester—		
Bars (Round)	9 2 6	—
" (Small Round)	8 10 0	—
Hoops (Baling)	10 0 0	9 15 0
" (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
" (Lancs. Boiler)	9 12 6 to 9 17 6	—
Sheffield—		
Siemens Acid Billets	9 10 0	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	7 0 0	—
Hoops	9 10 0	—
Soft Wire Rods	7 15 0	—
Midlands—		
Small Rolled Bars	8 5 0 to 8 15 0	—
Billets and Sheet Bars	6 7 6 to 6 12 6	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 12 6 to 13 15 0	—
Angles	8 2 6	—
Joists	8 2 6	—
Tees	9 2 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 15 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	18/3 to 18/9
Block Tin (cash)	195 15 0
" " (three months)	198 15 0
Copper (cash)	72 0 0
" (three months)	71 7 6
Spanish Lead (cash)	23 13 9
" " (three months)	23 7 6
Spelter (cash)	26 17 6
" (three months)	26 8 9
Manchester—	
Copper, Best Selected Ingots	77 5 0
" Electrolytic	84 10 0
" Strong Sheets	112 0 0
" Tubes (Basis Price), lb.	0 1 3½
Brass Tubes (Basis Price), lb.	0 1 1½
" Condenser, lb.	0 1 3½
Lead, English	25 5 0
" Foreign	23 10 0
Spelter	26 18 9
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	2/11 per lb.	
Ferro Tungsten	2/9 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£25 0 0	7/6
" 6 p.c. to 8 p.c.	£24 0 0	7/-
" 8 p.c. to 10 p.c.	£23 10 0	6/-
" Specially refined		
" Max. 2 p.c. carbon	£36 0 0	12/-
" " 1 p.c. carbon	£38 0 0	15/-
" " 0·70 p.c. carbon	£42 0 0	17/-
" " carbon free	1/2 per lb.	
Metallic Chromium	2/6 per lb.	
FerroManganese (per ton)	£13 15 0 for home; £13 10 0 for export	
" Silicon, 45 p.c. to 50 p.c.	£12 0 0 scale 5/- per unit	
" " 75 p.c.	£19 10 0 scale 6/- per unit	
" Vanadium	13/- per lb.	
" Molybdenum	4/- per lb.	
" Titanium (carbon free)	1/- per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/4 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
Lanarkshire	
(f.o.b. Glasgow)—Steam	13/6
" " Ell	14/-
" " Splint	15/6 to 16/-
" " Trebles	14/3
" " Doubles	13/6
" " Singles	12/-
Ayrshire—	
(f.o.b. Ports)—Steam	13/3
" " Jewel	17/6
" " Trebles	13/9
Fifeshire—	
f.o.b. Methil or Burntisland—Steam	12/3 to 13/6
Screened Navigation	17/6
Trebles	14/6
Doubles	13/6 to 13/9
Singles	12/-
Lothians—	
(f.o.b. Leith)—Best Steam	13/-
Secondary Steam	12/6
Trebles	14/6
Doubles	13/6
Singles	12/-

ENGLAND.

	Inland.
(8) N.W. Coast—	
Steams	24/- to 25/-
Household	38/- to 51/-
Coke	22/6 to 23/6
Northumberland—	
Best Steams	14/9 to 15/-
Second Steams	13/6 to 13/9
Steam Smalls	9/6 to 10/6
Unscreened	13/- to 13/3
Household	21/- to 26/-
Durham—	
Best Gas	15/9 to 16/-
Second	15/6 to 15/9
Household	21/- to 27/-
Foundry Coke	22/- to 28/-
Sheffield—	Inland.
Best Hand-picked Branch	27/- to 28/6
Derbyshire Best Bright House	20/- to 23/-
Best House Coal	19/6 to 20/6
Screened House Coal	17/6 to 18/6
" " Nuts	16/- to 17/6
Yorkshire Hards	15/6 to 16/6
Derbyshire Hards	15/6 to 16/6
Rough Slacks	8/6 to 9/6
Nutty Slacks	6/- to 7/-
Smalls	2/- to 4/-
Blast-furnace Coke (Inland)	14/6 at ovens
Furnace and Foundry Coke (Export), f.o.b.	20/6

(9) SOUTH WALES.

Cardiff—	
Steam Coals :	
Best Smokeless Large	19/9 to 20/-
Second Smokeless Large	19/6 to 19/9
Best Dry Large	19/- to 19/6
Ordinary Dry Large	18/- to 18/6
Best Black Vein Large	18/9 to 19/-
Western Valley Large	18/3 to 18/9
Best Eastern Valley Large	18/- to 18/3
Ordinary Eastern Valley Large	17/3 to 17/9
Best Steam Smalls	13/3 to 13/9
Ordinary Smalls	12/6 to 13/-
Washed Nuts	20/- to 23/-
No. 3 Rhondda Large	20/6 to 21/-
" " Smalls	15/- to 15/6
No. 2 " Large	17/6 to 18/-
" " Through	16/- to 17/-
" " Smalls	13/- to 13/6
Foundry Coke (Export)	26/6 to 36/-
Furnace Coke (Export)	21/- to 23/-
Patent Fuel	20/- to 21/6
Pitwood (ex ship)	26/- to 26/3
Swansea—	
Anthracite Coals :	
Best Big Vein Large	33/- to 36/6
Seconds	27/6 to 30/-
Red Vein	23/- to 27/-
Machine-made Cobbles	40/- to 44/-
Nuts	40/- to 44/-
Beans	23/6 to 25/6
Peas	17/9 to 18/6
Breaker Duff	9/- to 9/6
Rubbly Culm	9/9 to 10/3
Steam Coals :	
Large	18/- to 19/-
Seconds	17/- to 18/-
Smalls	10/6 to 13/-
Cargo Through	15/6 to 16/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated.

coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield.

(*c*) Delivered Birmingham. (*d*) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our Correspondent in Paris.)

Aviation.

SINCE the Air Minister undertook the task of reorganising the air services little has been done in the way of record attempts, and the fact that permission has been granted for a renewal of record flights implies that the reorganisation is so far advanced as to reduce the risk of failures, which have been too frequent in the past. A good deal of useful work appears to have been accomplished during the past few months, and, with the considerably larger credits placed at the disposal of the Air Minister, progress has been made alike in the technical side of aviation, civil aviation and the Air Force. The successful meeting at Vincennes was regarded as marking a new era in air development in France. Nothing will be done to check this good impression, and the machines which are being prepared for the Schneider Cup race will not compete unless they render a good account of themselves in the trials which are to start a month hence.

Airships.

The incidents that attended the forced landing of the "Graf Zeppelin" near Toulon, and its housing in the hangar at Cuers-Pierrefonds for a week, have attracted a good deal of attention to the airship in France. The unfortunate experience with the "Dixmude" and other dirigibles left the French so far sceptical regarding the practical value of the lighter than air machine that their construction was entirely abandoned until recently, when a small experimental semi-rigid airship was built for military purposes. French experts have been given full opportunity to examine the "Graf Zeppelin," and some have made journeys in it. The experience thus gained appears to have modified the attitude of many experts towards the airship.

Hydro-electric Works.

The construction of the Castillon barrage on the Verdon, a tributary of the Durance in the Basses-Alpes, marks another stage in the execution of the programme which is providing the country with an extensive supply of electrical energy. France is already the third greatest producer of such energy, and it is hoped that the cheap motive power thus available in the Alps and the Pyrenees will result in the creation of great industrial centres, while an important outcome is the possibility of saving a large yearly expenditure in imported fuel. The enterprise has proved highly successful in the Isère, which was already an industrial region, and is well provided with railway communication, but in the Basses-Alpes there are not the same facilities, and it has yet to be seen how the vast quantity of energy to be produced in the future at enormous distances from the great consuming centres will be distributed, without adding largely to the cost. In the construction of barrages special care is taken to do nothing that may detract from the local scenery, and it is declared that the lake to be created at Castillon will be one of the most picturesque in the country. It will have a length of 7½ miles and a width of nearly two miles, while the depth will be 360ft. Although some of the barrages in France are of a particularly interesting character, there is promise of still more novelty in one which it is proposed to construct across the river Our, near Vianden, between Luxemburg and Germany. A first barrage 350ft. high will form a lake about 12½ miles long and three-quarters of a mile wide. This barrage will provide 75 million kilowatt hours a year. The water leaving the turbines will flow into a second reservoir created by a barrage 125ft. high. The turbines of the lower barrage will assist the upper power-house when dealing with peak loads, and for the rest of the time they will return some of the water from the lower reservoir to the upper lake. In addition, it is proposed to construct underground galleries from adjacent rivers in order to increase the supply of water above the first barrage.

Midi Railway.

The work of electrifying the Midi Railway system is steadily progressing, largely with the aid of material supplied by Germany on account of reparations, and the greater part of the energy is supplied by the hydro-electric plants which have been laid down in the Pyrenees. Having increased considerably the carrying capacity of the system, the company now aims at developing the international traffic, and, for that purpose, extensive works are being carried out at the Pointe-de-Grave, at the mouth of the Gironde, where a port is being created for the ocean traffic, and, on the Mediterranean, Port-Vendres is being provided with every facility for dealing with the North African traffic. An additional means of communication with Spain will be afforded next month by the opening of the second tunnel at Ax-les-Thermes. All this forms part of a general programme of internal waterway and railway communication which aims at accelerating transport and securing for France as much as possible of the international traffic. The directors of the Midi Company hope that the tunnels through the Pyrenees will eventually divert over the French railways much of the Spanish traffic that is at present effected with England by water.

Continuous Brakes.

The Belgian railways have made arrangements for equipping all goods trains with continuous brakes, and orders have been placed with the Kunze-Knorr Company, of Berlin, for the supply of Westinghouse brakes on account of reparations to the value of 80 million francs, while the Ateliers de Constructions Electriques of Charleroi will provide similar brakes, the value of which will exceed 120 million francs. The number of vehicles to be fitted with brakes is 70,000, and the work will be carried out over a period of five years. When that is done, all the trucks and wagons in France, Belgium and the Central European countries will be equipped with interchangeable automatic brakes and the international goods service will be greatly accelerated.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

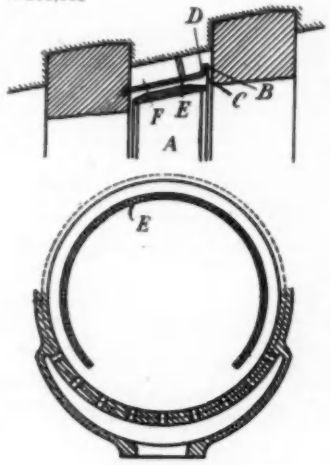
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

TURBINE MACHINERY.

283,505. January 11th, 1928.—DRAINING THE LOW-PRESSURE BLADING OF STEAM TURBINES, Aktiengesellschaft Brown, Boveri & Cie., of Baden, Switzerland.

According to this specification, most of the arrangements for draining the low-pressure blading of steam turbines do not afford effective means for withdrawing the whole of the water which condenses in the upper portion of the casing, so that a part if not the whole of such water is liable to flow back into the blading and cause damage in the succeeding stages. According to the invention, water thrown off from the moving

Nº283,505



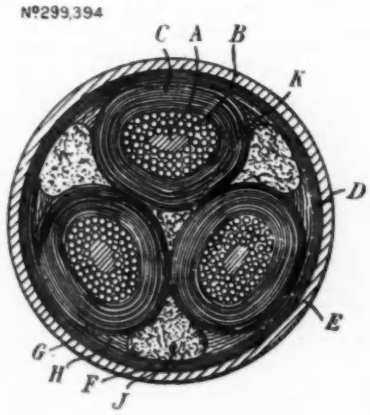
blades A enters a narrow slit B formed on one side by the entering edge C of the fixed blading, and on the other side by the lip D of the annular partition E. The water passes through this slit and enters the passage F formed on one side by the cylinder wall and on the other side by the annular partition E. The lower illustration shows the arrangement in elevation. The annular partition E occupies the upper part of the casing and preferably extends somewhat below the middle flange. In the lower part of the casing a partition is not necessary as the water drains away by gravity.—*April 11th*, 1929.

TRANSMISSION OF POWER.

299,394. October 23rd, 1928.—HIGH-TENSION CABLES, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.* 2.

This invention relates to multiple conductor high-tension underground cable. The object of the invention is to provide fillers of improved construction so that gas may be excluded from the interior of the cable as completely as possible. Each conductor is composed of a central conductor member A, with surrounding smaller conductors B. Surrounding each of the conductors thus formed are numerous layers of insulation C, composed of relatively narrow tightly-wound strips or ribbons of tough paper, the joint between adjacent strips in one layer being covered by other strips both above and below it. Surrounding the conductors and their individual insulations is an annular covering

Nº299,394



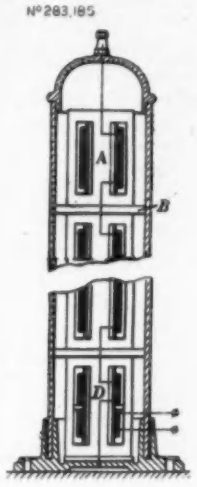
or belt of insulation D which may also be formed of paper, whilst outside the belt insulation there is a lead sheath E. Between the conductors and the belt insulation there are spaces F in which there are fillers. It is to the construction of these fillers that the invention is specifically directed. The sides of each filler where the space between the belt and conductor coverings contracts to a knife edge, as indicated at G, are composed of kraft paper strips H. The paper is cut into relatively wide strips and is passed through a suitable machine which crumples it and at the same time gives to it a wedge-like formation in cross-section and of any suitable length. Between two of these wedge-like strips there are jute cords J, which fill the remainder of the space. For the central space between the conductors a filler of crumpled kraft paper K is employed.—*April 18th*, 1929.

MEASURING AND TESTING INSTRUMENTS.

283,165. January 6th, 1928.—DEVICE FOR FEEDING LOW-TENSION MEASURING INSTRUMENTS FROM HIGH-TENSION SYSTEMS, Trüb, Täuber and Co., of 3, Amperestrasse, Zürich 6, Switzerland, and Alfred Imhof, of 52, Breitestrasse, Winterthur, Switzerland.

A number of choking coils, wound with wire of high specific resistance and of low temperature coefficient, are connected in series between the measuring conductor and the primary winding of a current transformer, which is earthed at its free end. The purpose of the current transformer is to amplify the primary current so that the resistance can be designed to pass a very low current and hence have a small energy consumption. The low-tension apparatus is connected to the secondary winding of the current transformer. In the drawing four choking coils A of the same form are connected in series and wound with fine resistance wire on the central iron members of the cores. The individual cores are separated one from another by the insulating discs B. D is the current transformer, which supplies the voltmeter.—*April 8th*, 1929.

Nº283,165

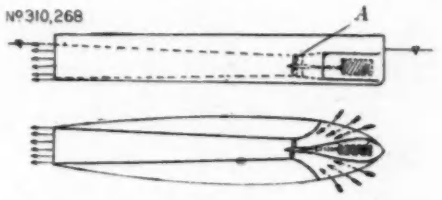


SHIPS AND BOATS.

310,268. September 24th, 1928.—SCREW PROPELLERS, L. Kort, 8, Lützerodestrasse, Hanover, Germany.

This invention covers a variation of the known system of arranging a screw propeller in the constructed portion of a submerged tunnel. The tunnel, in which the screw A works

Nº310,268



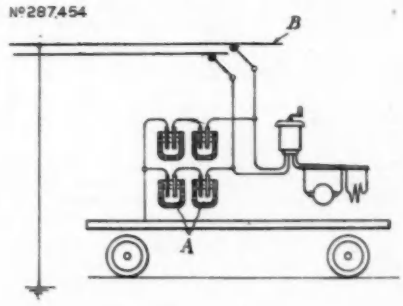
diverges rapidly towards the bow, inlet end, and less rapidly towards the stern, as shown. It is claimed that in this way frictional losses are reduced. The divergence towards the stern is carried out laterally, rather than vertically, so as to reduce the draught of the vessel.—*April 25th*, 1929.

MOTOR CARS AND ROAD TRAFFIC.

287,454. March 13th, 1928.—ELECTRIC PROTECTIVE DEVICES, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.* 2.

In accordance with this invention an insulated electric road vehicle, such as a trolley omnibus, is equipped with an arrangement which avoids the danger of passengers receiving shocks. One of the overhead wires, it will be noted, is earthed, and between the lead-in cables from the trolley arms and the frame

Nº287,454



of the vehicle electrolytic cells A are connected. With these cells connected up in reverse directions between the two power conductors, the one-way discharge action of one of the electrolytic cells insures that the frame of the vehicle is substantially at the potential of one of the supply conductors depending on the polarity of the conductors. This with the trolley arm B earthed at suitable points throughout its length and the cells arranged for reverse discharge action, the frame is always maintained at practically earth potential.—*April 25th*, 1929.

METALLURGY.

310,226. June 16th, 1928.—A FLUX FOR SOLDERING ALUMINIUM, W. Reuss, Burgermeister-Fuchsstr., 34, Mannheim, Germany.

The inventor describes his flux, as comprising 30 parts of flux, consisting of equal parts of borax, boracic acid, and caustic potash, mixed with 15 parts of common salt and one part of sulphuric acid. When welding with this medium, he says, "the flow of the metal is increased to such an extent that the liquid metal does not only prevent the formation of oxide at the joint, but even forces aside the superficial oxide films which form. It is, therefore, possible to form, by means of this welding medium, without agitating it at the weld, a perfect silver-white welded seam, so that by means of this medium the extremely difficult process of welding of aluminium and its alloys can, even in the case of thin sheets, be effected in a cheap and economical manner. With the new welding medium, not only aluminium, but also other metals—such, for example, as steel, grey castings, tempered castings, steel castings, brazier's castings, brass and copper—can be advantageously welded. The new welding medium is also suitable for welding alloys of

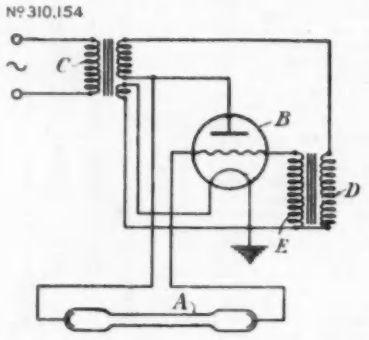
aluminium with other metals—such, for example, as copper, magnesium and zinc, with slight additions of manganese, nickel or iron."—*April 25th*, 1929.

LIGHTING AND HEATING.

310,154. March 19th, 1928.—LIGHTING INSTALLATIONS COMPRISING ONE OR MORE DISCHARGE TUBES HAVING A HIGH STARTING VOLTAGE, *Stanley Gordon Sinclair Dicker, of* 20 *to* 23, *Holborn, London, E.C.* 1.

In view of the fact that neon tubes require a higher voltage for ignition than they need for their normal operation, it is proposed to employ a thermionic oscillating valve connected

Nº 310,154



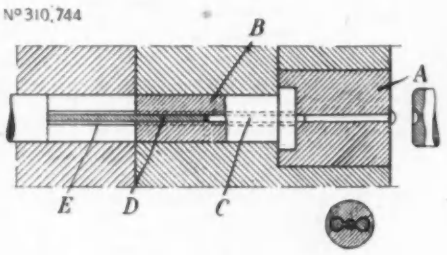
in the manner shown in the accompanying diagram, where A is the neon tube and B the valve. The transformer C is connected to an alternating-current supply. Owing to the shape of the curve of the oscillations, the windings D and E have voltages of high peak values induced in them, and these peaks are used to operate the neon tube. The arrangement gives very high peak voltages at a comparatively low mean voltage. —*April 25th*, 1929.

MACHINE TOOLS AND SHOP APPLIANCES.

310,744. October 12th, 1928.—COLD-HEADING MACHINES, K. Nagel und J. G. Kayser Aktiengesellschaft, Peterstrasse 41, Nurenburg, Germany.

It is difficult to make cold-headed bolts having shanks of a greater length than eight diameters in solid dies on account of the force necessary for their ejection. This force may be so great as to make the ejector buckle up. In the drawing the solid

Nº 310,744



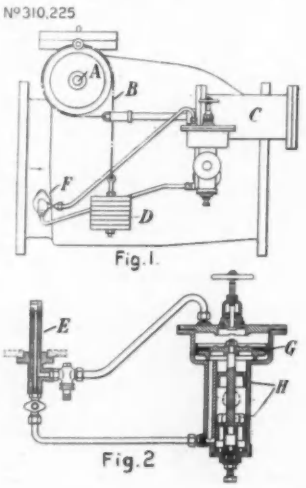
die is shown at A. Behind it there is a sleeve B, which is bored with three holes, as shown in the cross section. The three holes are connected by slots. The central hole contains the ejecting needle C which is the same size as the bolt. The outside holes are of larger bore. The ejector bar D is of such a cross section that it fills all three holes and the connecting slots so that it can be made much stiffer than the plain needle, and is not liable to buckle, where it is unsupported at E.—*May 2nd*, 1929.

MISCELLANEOUS.

310,225. June 12th, 1928.—BACK-PRESSURE VALVES, R. A Blakeborough and H. Tart, Woodhouse Works, Brighouse, Yorks.

This reflux valve is operated, according to the rise and fall of the pressure in the pipe it controls, by means of a Pitot tube and a servomotor. The valve itself is pivoted on the shaft A, and is worked through the chain B by the cylinder C. D is a

Nº 310,225

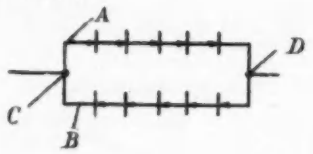


counterweight. The Pitot tube, shown in detail at E in Fig. 2, is mounted in the valve body at F—see Fig. 1—and its two orifices are connected with the opposite sides of a piston G—Fig. 2—which controls a double-beat valve H that regulates the admission of pressure water to the cylinder C and, consequently, the opening and closing of the main valve A.—*April 25th*, 1929.

309,514. December 12th, 1927.—RESISTANCE SHUNTS, Graham Leigh Porter and Ferranti, Ltd., both of Hollinwood, Lancaster.

The object of this invention is to provide shunts which possess a rapidly falling resistance characteristic with rise in current. The diagram shows a shunt circuit comprising two parallel branches A B, in each of which a number of metal rectifier units is included, the number of units chosen being such that, when the voltage across the points C D is just sufficient to operate the

Nº 309,514

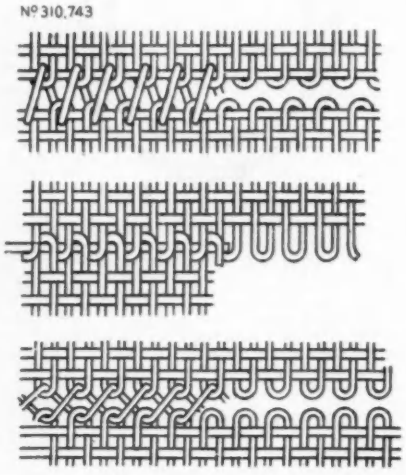


relay or other apparatus to which these points are connected, the resistance of the shunting rectifiers is too high appreciably to affect the voltage drop between points C and D, but upon a large increase in current flowing in the circuit comprising the relay or other apparatus and the shunting rectifiers the resistance of the latter will drop to a low value, thus considerably reducing the voltage drop between the points C D. The invention is particularly applicable in connection with the protection of alternating-current feeders or distributors.—*April 12th* 1929.

310,743. October 11th, 1928.—JOINING THE ENDS OF WIRE CLOTH, M. Czaplinski, of Ziethenstrasse 72, Berlin-Neukölln, Germany.

Numerous methods are, it is pointed out, known for the production of endless wire cloths for the manufacture of paper, the best of which consist in joining the last weft wire of each of the two ends of the sieve by hard soldering or welding to the warp wires and then making a permanent sieve seam by binding the two opposite wires round with a sewing wire. In the process described in the specification, the weft and the warp are not welded or soldered to one another, but the last weft wire or wires of each end are removed by simple drawing out, and the ends of the adjacent warp wires thereby set free are brought together in pairs and joined by welding or soldering. There is then produced a loop or ring formed by each two warp wires, by the aid of which the uniting seam for the production of the

Nº 310,743

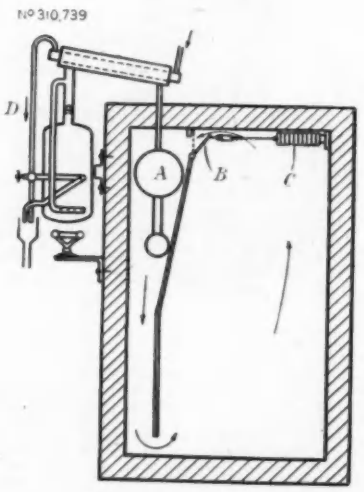


endless cloth can be made. The accompanying drawings illustrate three constructional examples of the seams produced by means of the loops thus formed. The loop which is formed from the ends of two warp wires may be made as long as is desired. If this length is somewhat increased, the advantage is obtained that an eye extending obliquely downwards from above is produced, whereas in the known welding or soldering of the last weft wire to the warp a vertical mesh aperture is produced. The new sieve or the new seams are distinguished from all known devices of a similar type by the fact that no bulge is produced at the join.—*May 2nd*, 1929.

310,739. October 5th, 1928.—INTERMITTENT ABSORPTION REFRIGERATING APPARATUS, J. Orten Boving, Victoria Station House, Westminster.

The object of this invention is to regulate the evaporation in

Nº 310,739



the evaporator A of an intermittent refrigerator, according to the demands of the cold chamber. For this reason, the evaporator is arranged in a comparatively confined space, within the cold chamber, so that a draught is created downward through this space. This draught is regulated by the damper B, which is controlled by the thermostat C, and the cooling action correspondingly adjusted. The refrigerating apparatus D is of normal design.—*May 2nd*, 1929.

310,625. March 22nd, 1928.—PLATES FOR ELECTRIC CONDENSERS, *James Yate Johnson, of* 47, *Lincoln's Inn-fields, London.*

The conductive plates of condensers consist of metal foil. According to this invention, electric condensers are made up from foils obtained by uniformly incorporating finely divided electrically conductive materials, such as metals, graphite, charcoal, &c., with paper pulp, and then working up the mixture into foil of suitable thickness, as, for example, in the manner which is customary in the paper manufacture. It has been found that the resulting foils are very good conductors of electricity. Two examples of the invention are given :—(1) A paper pulp, made from rags, is intimately mixed with about 50 per cent. by weight of graphite powder, relatively to the dry matter of the pulp. The mass is then treated in the usual manner for making paper, and foils having very good electrical conductive properties are obtained. (2) A wet paper pulp is intimately mixed with about 50 per cent. by weight of powdered aluminium, relatively to the dry matter of the pulp. The mass is then treated in the usual manner for making paper, and the foils are passed between rollers and completely dried, either simultaneously or subsequently. The foils can be cut into any desired size with ease and possess a very good electrical conductivity.—*May 2nd*, 1929.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the* TIME *and* PLACE *at which the meeting is to be held should be clearly stated.

TO-DAY.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, London, W. 1. Discourse, "The Air Pump : Past and Present," by Dr. E. N. da C. Andrade. 9 p.m.

MONDAY, JUNE 3RD.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, London, W. 1. General Meeting. 5 p.m.

TUESDAY, JUNE 4TH.

ILLUMINATING ENGINEERING SOCIETY.—In the Lecture Theatre of the Royal Society of Arts, 18, John-street, Adelphi, London, W.C. Annual general meeting. Annual report of the Council. "Some Further Applications of Synchronously Intermittent Light for Revealing Moving Machinery," by Dr. J. F. Crowley. 6.30 p.m.

TUESDAY TO FRIDAY, JUNE 4TH TO 7TH.

INSTITUTION OF GAS ENGINEERS.—At the Institution of Civil Engineers, Great George-street, Westminster, S.W. 1. Annual general meeting. 10 a.m. each morning.

WEDNESDAY, JUNE 5TH.

INSTITUTION OF CIVIL ENGINEERS : MANCHESTER AND DISTRICT ASSOCIATION.—Visit to Rochdale Waterworks. Leave Manchester (Victoria) 1.35 p.m.

WEDNESDAY TO SATURDAY, JUNE 5TH TO 15TH.

INTERNATIONAL FOUNDRY TRADES' EXHIBITION.—Royal Agricultural Hall, Islington, London, N. 1.

FRIDAY, JUNE 7TH.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, Piccadilly, London, W. 1. Discourse, "Excavations at Ur, 1928-1929," by Mr. C. Leonard Woolley. 9 p.m.

FRIDAY TO THURSDAY, JUNE 7TH TO 13TH.

INSTITUTION OF GAS ENGINEERS.—Visit to Berlin for the meetings of the German Gas and Water Association, and to visit the German Gas and Water Exhibition.

THURSDAY TO SATURDAY, JUNE 6TH TO 15TH.

INTERNATIONAL HIGH TENSION CONFERENCE.—Paris. For provisional details see page 413, April 12th, 1929.

TUESDAY TO SATURDAY, JUNE 11TH TO 22ND.

INSTITUTION OF ELECTRICAL ENGINEERS.—France. Summer meeting. For programme see page 331, March 22nd, 1929.

TUESDAY TO FRIDAY, JUNE 25TH TO 28TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Manchester. Summer meeting. For programme see page 302, March 15th, 1929.

TUESDAY, JULY 2ND.

INSTITUTION OF ELECTRICAL ENGINEERS : SOUTH MIDLAND CENTRE.—Summer meeting. Visit to the Avonmouth Docks. Assemble main booking hall, G.W.R., Snow Hill, Birmingham. 11 a.m.

TUESDAY TO THURSDAY, JULY 2ND TO 4TH.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Bolbec Hall, Newcastle-upon-Tyne. Summer meeting in Newcastle-upon-Tyne, jointly with the Institution of Engineers and Shipbuilders in Scotland. "The Story of Safety at Sea," by Sir Westcott S. Abell ; "Developments in the Uses of Electricity," by Mr. R. P. Sloan ; "The Applications of Monel Metal in Engineering and Shipbuilding," by Mr. John Ireland ; "Some Notes on Damage to Ships," by Mr. J. L. Adam.

TUESDAY TO FRIDAY, JULY 2ND TO 5TH.

BRITISH WATERWORKS ASSOCIATION.—Portsmouth. For programme see page 447, April 19th, 1929.

WEDNESDAY TO FRIDAY, JULY 10TH TO 12TH.

ELECTRICAL ASSOCIATION FOR WOMEN.—Fourth Annual Conference at the North-East Coast Exhibition, Newcastle-on-Tyne.

TUESDAY TO SATURDAY, JULY 9TH TO 13TH.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.—Royal Show at Harrogate.